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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

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Vol. 20. 256 BROADWAY, NEW YORK. No. 52

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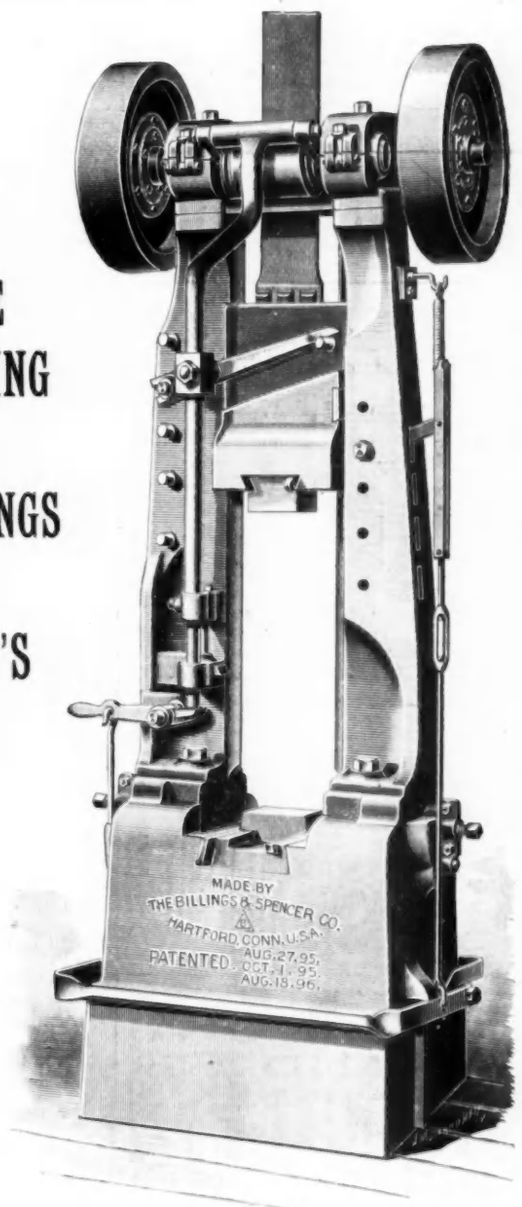

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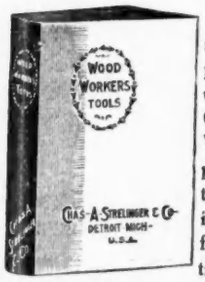

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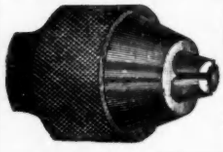

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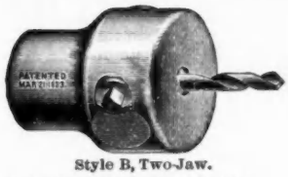

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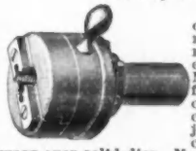

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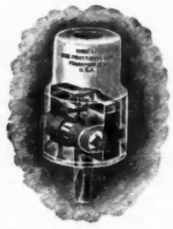

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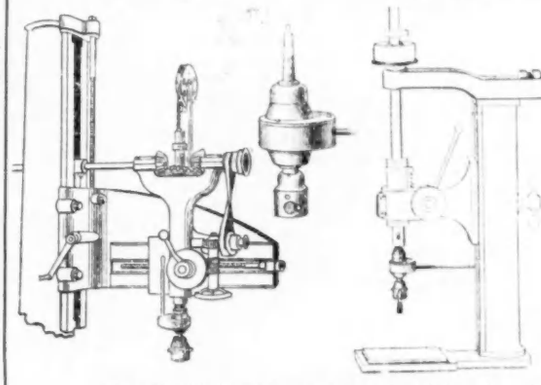

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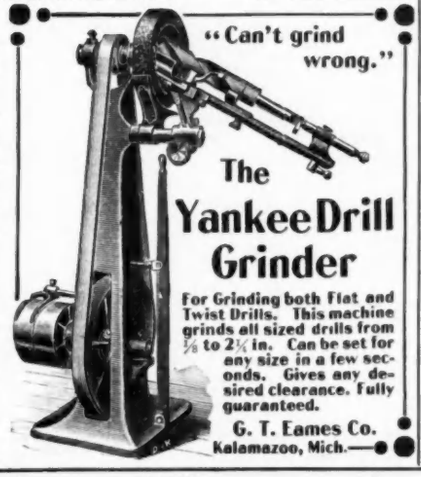

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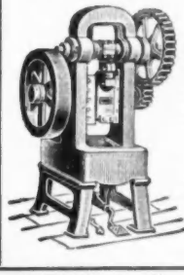

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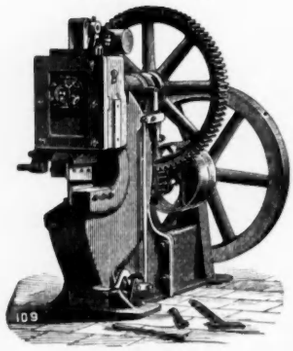

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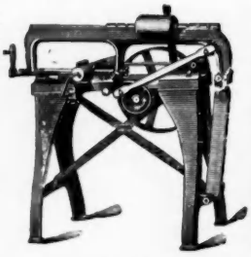

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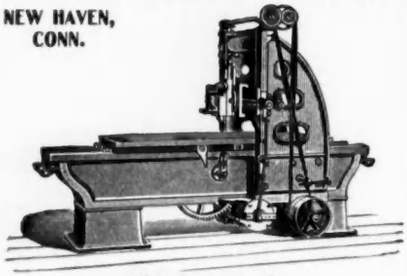

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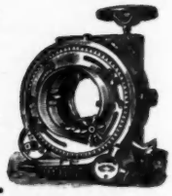

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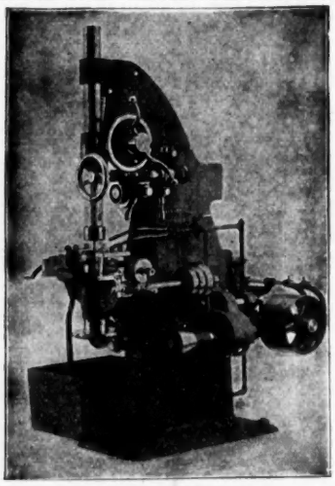

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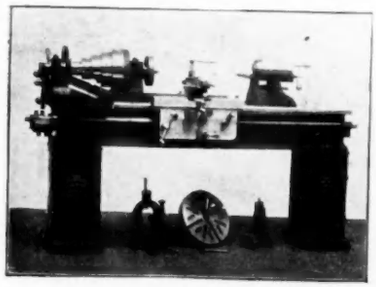

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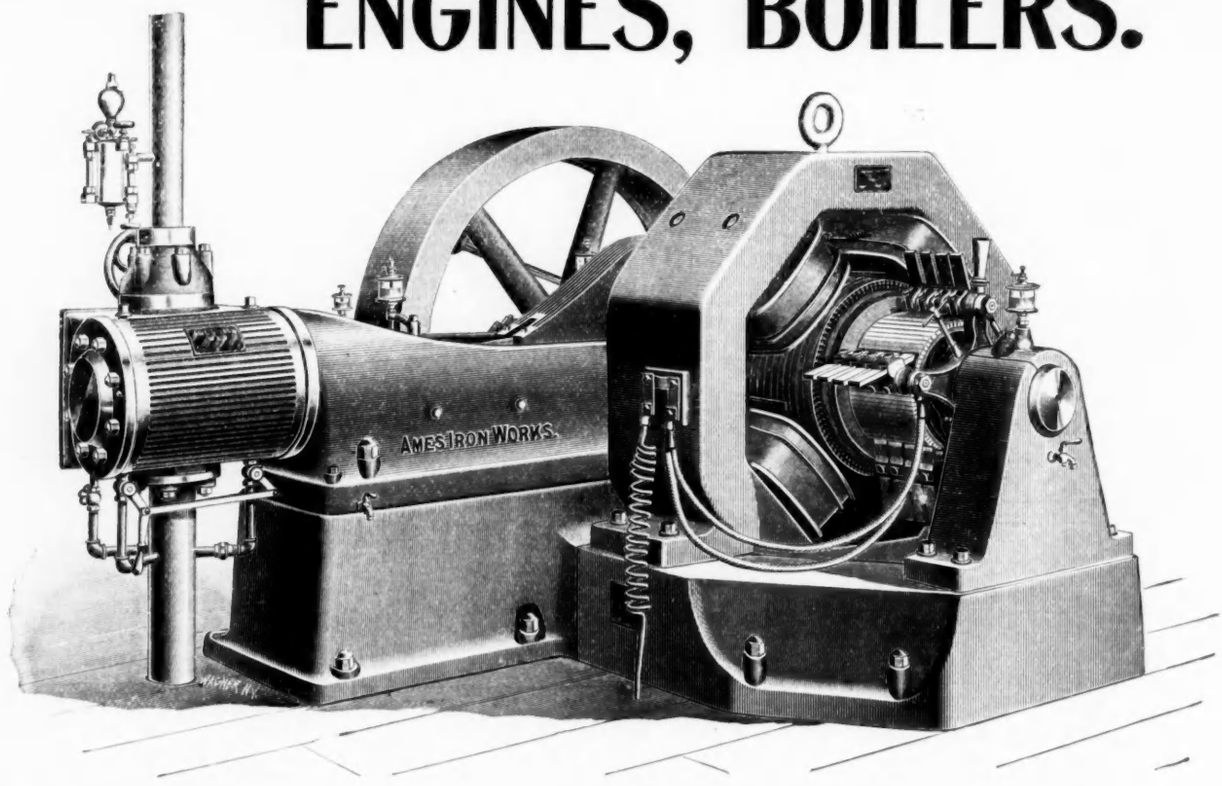

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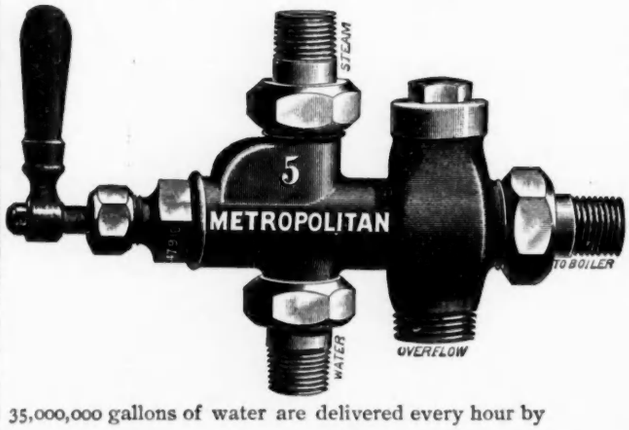

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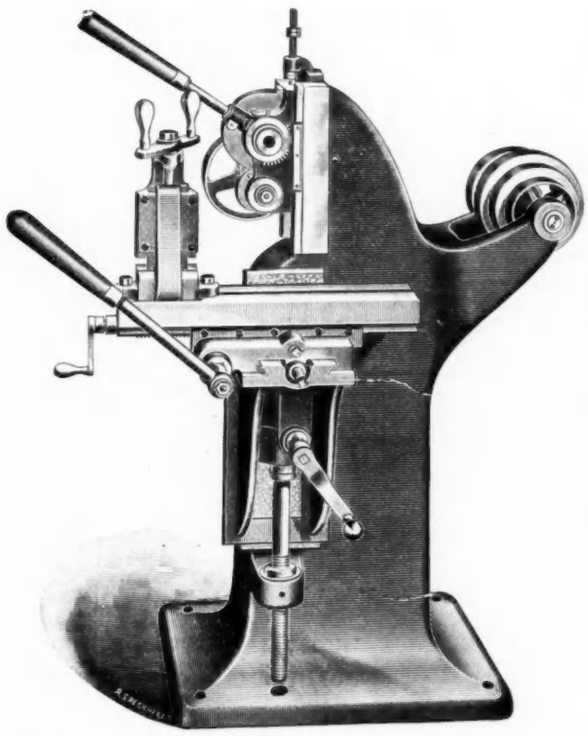

has a number of special features which are of great advantage.

The spindle head has a vertical lever feed and is accurately counterbalanced, making it possible to do light and sensitive milling on heavy work without danger of breaking cutters.

The spindle is geared, and has sufficient power to do quite heavy work when required.

The spindle head can be locked at any position within the limit of its adjustment, making it rigid with the frame, as in the case of an ordinary hand milling machine.

An adjustable stop is located above the head, so that any number of cuts may be made of a uniform depth.

The table has a rack feed operated by hand lever, and also a screw feed operated by a crank. The change from one to the other can be made instantly by tightening or loosening one screw.

The knee has a vertical feed operated by crank, and the screw is provided with ball-bearing thrust collars for reducing the friction.

It is the best machine on the market for cutting Key-ways for The Woodruff Patent System of Keying.

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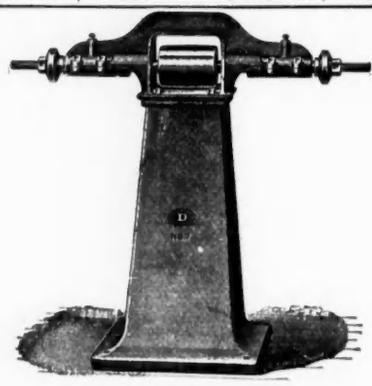

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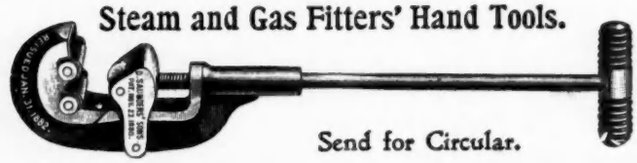

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The Contents will be found on page 9 with the Alphabetical Index to Advertisements. ::

The Buyers' Finding List will be discontinued.

The entire front page, under the heading, will be given for the price of the former smaller space—namely, $100 per issue. It can not be bought permanently by anybody—it's a special space any advertiser can have when vacant. It is sold for all the issues to February 12. ::

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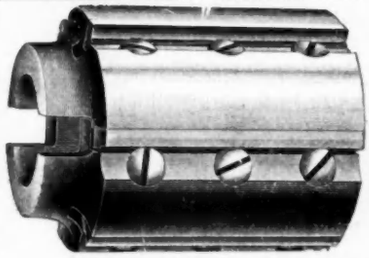

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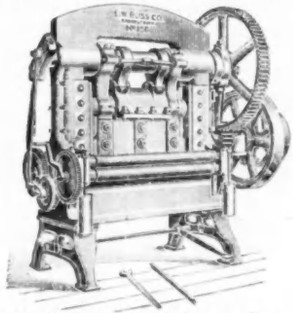

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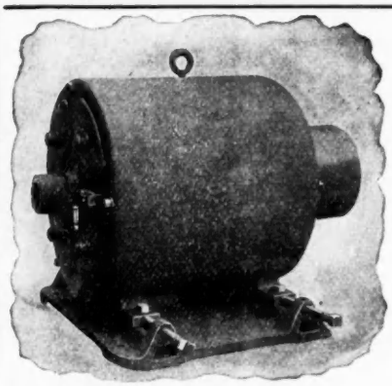

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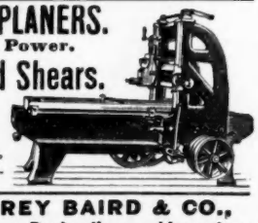

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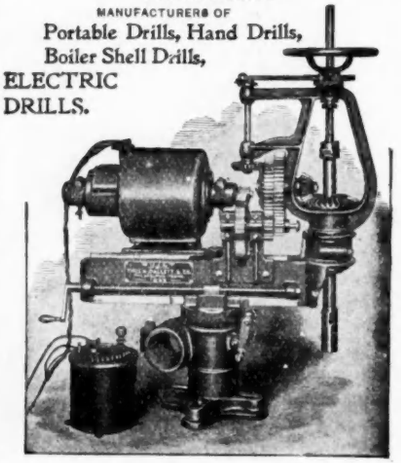

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20-37 x 14 Illingsworth Gap.
20 x 14 Pond, C. R. and F. C. F.
20 x 10 Lodge & Davis, taper.
18 x 8 Prentiss, C. R. and H. S.
16 x 8 Dexter, C. R. and P. C. F.
15 x 5 Star, R. and F. and taper.
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16 x 6 L. & D. Fox Monitor.
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20 x 18 x 3 ft. New Haven.
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450-lb. Merrill Drop.
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Lee & Hunt Cold Saw Mch. with Engine.
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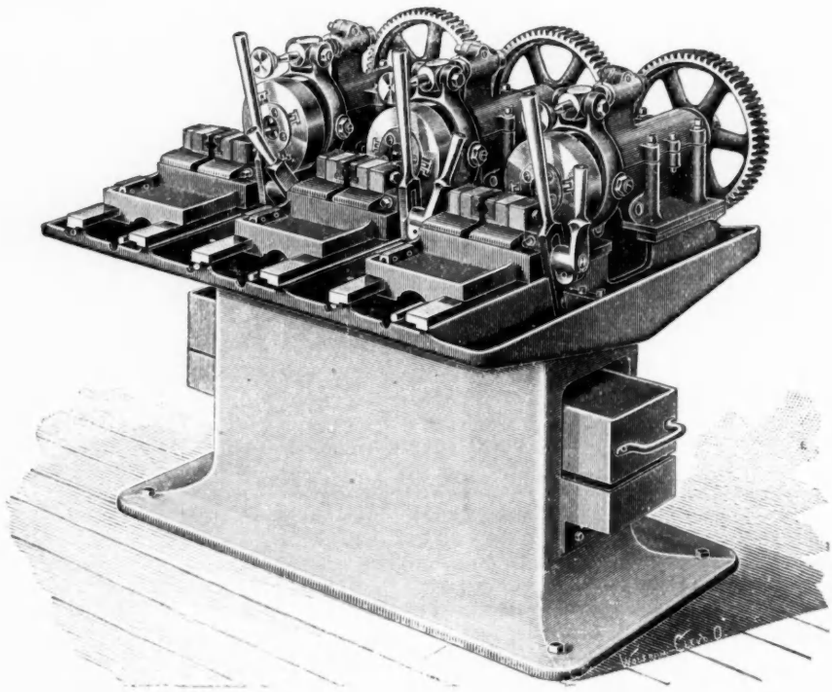

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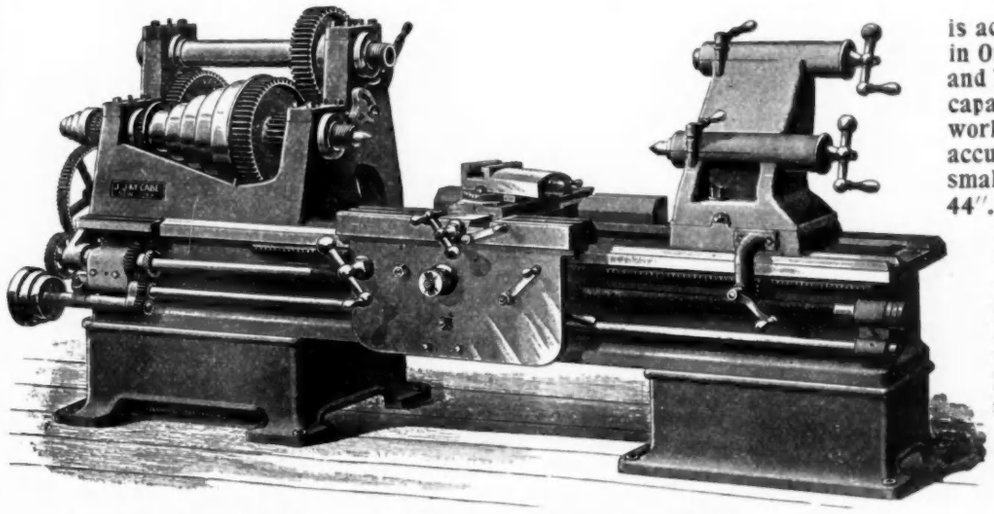

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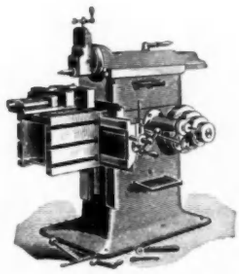

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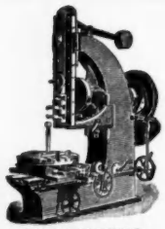

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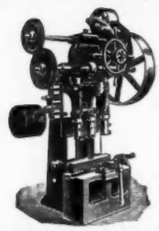

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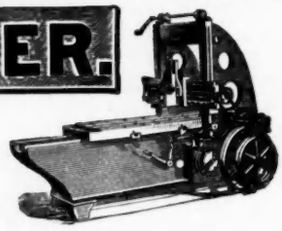

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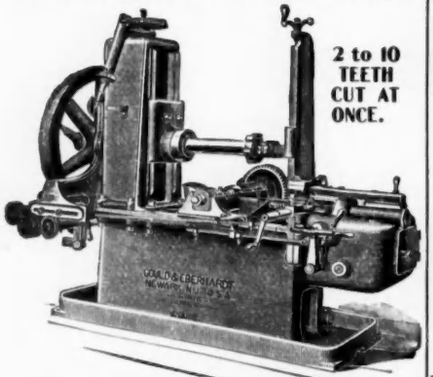

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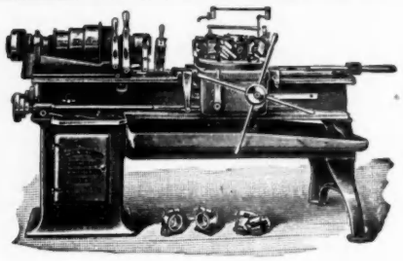

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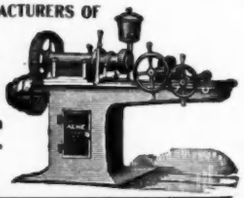

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A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

VOLUME 20. NEW YORK, THURSDAY, DECEMBER 30, 1897. NUMBER 52.

American Machine Tools in England.

Joseph Horner, of Bath, England, who occasionally contributes to our columns matter pertaining to English shop practice, has an article in "Engineering," of London, entitled "Some Lessons of the Stanley Show." After referring to the extent to which American tool builders have invaded the British market, and to the excuse made for this, that "English builders are too busy to supply the requirements of the bicycle factories," he says:

"Dismissing as a mere excuse the statement that English firms are too busy to make machinery for English cycle shops, we must seek elsewhere for the reasons why so anomalous a condition of things should exist.

"Of course one cannot suppose that American engineers and mechanics are more richly endowed with mechanical genius and skill than ourselves. But other qualifications than these are essential to success in a time like the present, when England is but one section of the world's workshop. Such qualities as these are of equal value, and under similar conditions of mechanical skill will turn the scale. One of these qualifications is to study the precise wants of users of machinery and tools, and to cater for those wants as carefully as possible, unhindered by preconceived ideas and conservative prejudices. This method involves not only questions of general design, but also the working out of an almost infinite number of minute details, including accessories, feeds, movements, both for saving time and conducing to efficiency of results; details which have their highest development now in the numerous automatic machines which do everything but talk, and which are at once expeditious, accurate and self-attending.

"The second condition is that the thought of finality must give place to that of progress. There is no machine which is so good but that it may be improved upon. If any real improvement is seen to be possible, then drawings, patterns, stamps and special tools must be altered or re-made, so that the best possible results are secured thereby.

"The more highly developed, the more complicated a machine becomes, the more perfect must its workmanship be. This involves the design of the most perfect machine tools and small tools for the production of this perfect work. And inasmuch as this is only possible financially by the sale of a large number of machines, it further includes the adoption of a perfect shop system, or that under which interchangeability of parts is secured, while the actual cost of labor on any single piece is almost infinitesimal—a fraction of a penny in some cases, in others a few pence or cents only.

"In these main reasons, with all that is involved in them, is to be sought the cause of the practical monopoly by the Americans of the cycle-making machinery. In these cardinal matters English methods and American methods differ substantially. We are conservative in method; they are alert and progressive. We tread in time-worn grooves; they seek more excellent ways. We do not adopt the interchangeable system to the same extent as they do. American shops are becoming increasingly specialised, and to a much greater extent than the English ones. There are few firms in America like Messrs. Tangye's, for example, in England, who manufacture machine tools, cranes, engines, pumps, boilers and many other articles. The number of those who are engaged in the general machine-tool trade, like Messrs. William Sellers & Co., is not large. Many of the firms confine their attention chiefly to a few types of tools only. One need only mention Messrs. Warner & Swasey for brass-finishers' tools, the Gisholt Company for specially heavy turret lathes, the Jones & Lamson Company for another class of turret lathes, the Pratt & Whitney Company for lathes and screwing machinery and measuring instruments, among many others. The consequence is that there is no finality in design thought of. Improvements are being constantly introduced, and the special machines, the products of particular firms, become as well known by name and number as the Whitworth threads or the Morse tapers.

"Each of the foregoing statements would bear much detail of illustration, but it must suffice now to state the facts; returning to the exhibits of the Stanley show.

"The principal interest in the machinery stands at the show centered in the screw machines. These were all automatic. Some of them, the Pratt & Whitney, are familiar, but the 'Cleveland' and the 'Spencer' are practically new to the English tool buyers. The Pratt & Whitneys have been in use in England during many years. There are about twenty-four at Enfield Small Arms Factory, attended by three men. There is no screw machine of English design which would cost so little for attendance. To illustrate the accuracy of the work turned out on these machines, I have seen screws taken at random from a machine at Enfield and tried in a hardened gage-plate. First the body is screwed into the plate, then the head is tried in a hole for the diameter. Next the body and head are tried in together to test their concentricity, and lastly the screw is laid in a recess cut in the edge of the plate to suit the profile of the screw. In all these tests the screws are not found wanting. Yet these screws, requiring the operation of eight or nine separate tools, are made for about 3d. per hundred.

"The Cleveland screw machines and the Spencers, both with vertical turrets, bear but little resemblance to the Whitney machines with horizontal turrets, but the results are admirable, and they were centers of attraction to thickly packed groups of visitors. Yet there was no screw machine of English design in the building. To make such machines as these, the highest specialisation in design and the best workmanship are necessary. In each instance all which the attendant has to do is to insert the length of rod or stock from which the screws have to be cut. The tools in the turret perform the various turning, threading and milling operations required, the tools in the cut-off rest part off the work, and the rod is fed forward automatically to the length required for the next screw. Lubrication is provided by a pump and pipe, or 'spreader,' with several openings over the work. Once started, the machine runs till the rod is used up.

"An instance of the American idea of gaining every second possible may be noticed in the action of the turrets and parting tools. The moment that each tool has finished its work, the turret moves back at a rapid rate, very much quicker

than the cutting speed, and after revolving to present the next tool, comes up rapidly until it nearly touches the work, and then slows down to the cutting speed. The parting tool also jumps back quickly the instant the work is cut off, to make room for the turret again.

"Excepting in so far as the employment of cam-operated movements is concerned, these screw machines have few points in common. They illustrate how inventive genius may accomplish similar ends through diverse designs, and that under the pressure of business rivalry the American tool-makers have not only ousted English screw machines from the cycle shops, but are able to offer a choice of several types of absolutely automatic machines, requiring not only no skilled attendance, but a single attendant can look after eight, ten, or even more, in some cases.* Should English firms attempt to regain what they have lost in this respect and recover the market by superior machines, they will have a long lee-way to make up. For it is vastly easier to lose a market than to recover it.

"Special types of lathes, of which English makes were either absent or poorly represented, were the screw machines with turrets for turning and boring hubs and cups, for facing sprockets, and doing other work of a cognate kind. It seems that to shape hubs with broad forming tools operating back and front, to screw threads with opening dies, to turn and bore sprockets, to mill edges from the turret, besides, much else, one must get American tools. No English machines were performing these operations at the show. The quantity of material removed in a few minutes by forming tools in turning hubs from the solid bar would have been pronounced impossible by any workman half a dozen years ago. But there remains the fact, nevertheless, that the hubs can be turned more cheaply thus than by using drop forgings in which the amount to be removed by turning is slight. So with the recesses in the sprocket wheels; these are perfectly interchangeable, because they are turned by nests of tools arranged somewhat similar to the tools in a boring head.

"In all these machines the bearings are so massive that any sensible wear is practically impossible. The slides are long, and scraped to accurate fits. All is substantial and stable, even though the work done is often of small size.

"There was a goodly collection of light lathes at the Stanley Show. A few were English, most were American. The former did not appear to advantage by the side of the latter. The American lathe has come here to stay. On the whole, it is a good machine; in several respects it is much handier than the English standard type. I am not speaking of the American lathe of twelve or fifteen years ago, but of the machine as it exists to-day. Of these there was a goodly selection, varying widely in design and in detail. Using a very old simile, the English might be likened to the great Spanish galleon, the American to the light English vessels. There are many little details about modern American lathes which may tend to facilitate the work of the turner and screw cutter, while the English lathes are made much as they were thirty years ago. To go into points of detail would occupy too much space, and they are more or less familiar to most users of machine tools.

"Not only in design, but in matters of detail of fitting and finish, the American lathes were superior to most of the standard types of English ones at the show. That does not say that they were superior to the best English machines, but then none of the best English firms were represented there. But if they had been, the American fitting would still have compared favorably with theirs. I tried many of the slides and screws at the different stands, and found the working smooth, easy, just sufficiently free, and without backlash or slop. Better work could not be desired. These were show lathes, but so also were those of English type in the same building, many of which were wanting in some of these details. The best English lathes were those which are made by firms who build in greater or less degree upon American design, and after American methods. The fact that several such firms have grown up in recent years illustrates the adage that 'imitation is the sincerest flattery.'

"In making comparisons at the show, one notices the incompleteness of some of the English tools by comparison with those of American design. This is observable in the friction-geared heads, in the wire feeds, in turret arrangements, in the lubricating apparatus, in stops, in the steadying and centering jigs, by the use of which eccentricity of turned and screwed parts is rendered impossible. The feeding of a flood of lubricant under pressure through the turret center along oil-tubed drills directly to the cutting point, is a nearly recent feature fitted to American turrets. The quantity of lubricant used, mostly expensive lard-oil, would frighten an old-time believer in the drip-can; but then, with tank-beds and trays and a centrifugal separator, the oil is almost wholly recovered and used again and again. The constant flood of lubrication also permits of heavy cutting, while the tool edges are preserved for a long period intact. The use of the turret is not confined so closely to the holding of single drills, reamers and cognate tools as it is with us. Box tools predominate, and these are so constructed that work is easily turned to thousandths of an inch, with true cutting tools, ground and set to correct angles. Though tools of this type are used in English shops, they have not reached so high a degree of development, and such infinite variations, as those sent from America. Exceptions occur in those English shops which are modelled on American lines and methods, such, for example, as the Small Arms Factory, at Enfield Lock. And it is easy to see why the tools endure so long without re-grinding; the rate of turning is not rapid, but there is no time lost, on the one hand, nor tools unduly forced by the introduction of the human element, and the lubrication is most abundant. The numerous milling machines, drilling, grinding and other machines must need be passed without observation. Sufficient has been said to indicate one direction in which English manufacturers have permitted the invasion of foreign machinery in large quantities, and even the English manufacturers go to the American agents for their small tools. At Churchill's I was shown £2,000 worth of American twist drills on shelves. Micrometers, calipers, milling cutters, reamers and all kinds of small tools for working metal and wood were also closely packed in ranges of shelving. There are six agents for American machinery in London alone, besides others in the provinces; and large numbers of machines are ready for immediate delivery. If a machine does not happen to be in stock, it can generally be delivered from America in from three weeks to a month. As regards prices of the ordinary machines, as a general statement, the best American machines cost more than those made by second-rate English firms, but less than those of the best Manchester firms. In reference to design and workmanship, the tools of the best American firms leave nothing to be desired. The Americans have made a point of catering for the English and Continental tool users, and their excellent systems of measurement and templet work enable them to make parts interchangeable. Perhaps it is not generally known that the firm of Pratt & Whitney* undertake the fittings of astronomical instruments as a regular part of their business. Another matter perhaps not generally known is, that while in the United States the rise-and-fall rest is mostly used, the lathes which are sent to England mostly have compound rests. The American lead screw often has five threads per inch. But lead screws of four per inch are supplied, if required for English use.

"Much more relating to the subject suggests itself to the mind, but this must suffice. These lessons of the show should be laid to heart by the great English firms, rich in capital, in prestige, in skill. In other directions there are not wanting indications that English manufacturers will be hard pressed in the near future. But one lesson is enough to learn at one time."

* The best results are obtained here with such machines by having them in charge of skilled men, though not necessarily thoroughly skilled all-round machinists.

* The firm of Warner & Swasey, of Cleveland, probably is meant.

Compressed Air Explosions.

BY FRANK RICHARDS.

At the recent meeting of the American Society of Mechanical Engineers, one of the most interesting of the papers presented was that of Mr. Geo. W. Dickie, manager of the Union Iron Works, San Francisco, on "Auxiliary Engines and Transmission of Power on Naval Vessels." The writer treated the hydraulic, the pneumatic and the electric systems quite fairly, and showed that either was competent, under intelligent and sympathetic direction, to do all the work required.

The paper was, unfortunately, presented at the last session, when little time could be allowed for discussion; but it is still somewhat singular that the only remark offered by any member in connection with the paper was a suggestion of danger in the use of compressed air. The danger referred to was not the bursting of pipes or cylinders or reservoirs through excessive pressure, but rather the possibility of the air being charged with atomized or vaporized oil and then ignited and exploded. Attention was called to some explosions of this character which have occurred with serious, and sometimes fatal results. Allusion was even made to the familiar principle of operation of the oil engine, where air is mixed with oil vapor, the charge compressed by the return stroke of the engine, and then ignited and exploded by the heat of the compression, with the suggestion that analogous conditions could occur in regular compressed-air practice.

Now, it does not seem proper to allow this to pass unchallenged. It was, of course, put forth in good faith, and may also be as honestly accepted by some; but still there is absolutely no occasion for alarm from this source. While it is of course possible to produce an explosion somewhat as suggested, it is not possible to do so without the grossest negligence and an absolute disregard of the essential conditions of economical air compression. The explosions of the character referred to have not been numerous, and they have not usually been with what might be considered very high pressure air. They have occurred, of course, mostly where compressed air has been most extensively used, and also where it has been most recklessly used. They have been in the earlier stages (not long ago) of compressed-air practice, or with people ignorant of the mechanical proprieties and careless of everything but making things hum. Such persons often succeed in making things fly, also.

The usual pressures in rock-drill practice are from five to seven atmospheres. Cheap compressors are often employed, with no provision for cooling the air, except a partial water jacketing of the cylinder, and it has been a not uncommon occurrence to have even the thin water jacket space choked up by mud and sediment. These compressors are often crowded to very abnormal speeds, especially by contractors engaged in driving tunnels. Of course, high temperatures are reached, both in the compressing cylinder and in the air receiver, which is usually located near the compressor. With the high temperature the natural accompaniment is difficulty in lubricating the cylinder; oil will be used in large quantities to be volatilized and mixed with the air, forming a notoriously explosive compound. If the compressor is run so that the lubrication actually fails entirely, and the piston begins to scrape and cut and strike fire, we have a very complete and satisfactory means of producing an explosion. The wonder would rather be if an explosion did not occur under such conditions. One or two such explosions occurred during the construction of the New York aqueduct, and one or two others have come to my knowledge.

Unless the piston actually strikes fire, as here suggested, and as pistons have been known to do, the conditions are still not equivalent to those that secure the explosion of the charge of the oil engine. In starting the oil engine, it usually takes ten minutes or more to heat up the retort, so that it will be able to ignite the compressed charge. After the engine gets running, the high temperature of the retort is maintained by the successive ignitions, but no ignition is caused by the heat of the compression alone.

The explosions can only occur under conditions such as those indicated, and such conditions cannot possibly occur with any methods and means of air compression which are even approximately correct. Such an explosion would not have been possible in the three-stage compressor delivering air at above 2,000 pounds pressure, which ran every day for a year, in this city, for supplying the Hardie motor cars. Such an explosion would not have been possible in connection with the four-stage compressor installed in this city for delivering air at 2,500 pounds pressure. It would have been impossible for two reasons, either of them sufficient and final. The air would not at any time have a sufficient proportion of volatilized oil to form an explosive mixture, and it would never attain a temperature that could cause ignition. Such an explosion would not be possible with any compressor that could be installed upon any United States vessel of war, because too much is known of the necessity of efficient cooling of the air in the several stages of compression. Such an explosion would not be possible anywhere in these days, with the knowledge and consent of anyone who had the slightest knowledge of and experience in air compression. That theorists who are nothing but theorists are able to find theory for alarm, is not to be wondered at, for theory can be found for anything, if the theory is sufficiently incomplete. Probably nothing has suffered more from pseudo theories and pseudo theorists than compressed air.

▲ ▲ ▲

Divider Points for Vernier Calipers.

There seems to be nothing made by the manufacturers of fine machinists' tools in the way of dividers that will bear comparison, in quality, with the different forms of calipers that are made. I have felt the need of a tool that was more convenient, of greater range and generally better than the usual forms of dividers found in the supply stores. Not that there are not good dividers made, but even the best do not seem to me to come up to the requirements for lining out and testing distances in jig, die or other similar work that requires considerable accuracy—particularly for spaces or divisions of from 2 to 24 or more inches.

I like the idea of the parallel point divider, as made by different firms, and have owned several; they are something on the pattern of the pump divider, but they have the appearance of a screw machine job turned out by the quart, and I am sorry to say that those I have inspected have justified this first impression.

There is a style of beam caliper I have seen quite frequently (not a store tool, but made generally by the man owning it) that has some good points—two, usually; that is, when one of them is not dulled or broken. The points are upon the opposite edge of the beam from the jaws of which they are a part, as shown in Fig. 1. These points are hard to keep sharp, in comparison with something that can be sharpened as easily as a piece of round wire; are in the way at times, and so are liable to become bent or broken, and are rather too close to the beam to be convenient.

After thinking the matter over some time, I designed the attachment shown in Fig. 2, which seems to answer the purpose. It makes a handy tool for getting distances on jig work from a central point to any number of holes or points at the same or varying distances from the center or from an edge. It is handy on die work, when holes or arcs of circles have to be laid out accurately. It is not as good as a pair of dividers for marking small circles, perhaps, but it has a range of usefulness beyond them, is stiff and, I think, not too heavy or clumsy.

I have been through with the different forms of trammel points, beam compasses, etc., and I prefer this rig to any of them. Anyone who has a vernier beam caliper or caliper square, can put this attachment upon them, and it does not interfere at all with the other uses that they were originally intended for, and you have the added advantages of an accurately graduated scale and fine screw or vernier adjustment.

I have seen in the "American Machin-

than the cutting speed, and after revolving to present the next tool, comes up rapidly until it nearly touches the work, and then slows down to the cutting speed. The parting tool also jumps back quickly the instant the work is cut off, to make room for the turret again.

"Excepting in so far as the employment of cam-operated movements is concerned, these screw machines have few points in common. They illustrate how inventive genius may accomplish similar ends through diverse designs, and that under the pressure of business rivalry the American tool-makers have not only ousted English screw machines from the cycle shops, but are able to offer a choice of several types of absolutely automatic machines, requiring not only no skilled attendance, but a single attendant can look after eight, ten, or even more, in some cases.* Should English firms attempt to regain what they have lost in this respect and recover the market by superior machines, they will have a long lee-way to make up. For it is vastly easier to lose a market than to recover it.

"Special types of lathes, of which English makes were either absent or poorly represented, were the screw machines with turrets for turning and boring hubs and cups, for facing sprockets, and doing other work of a cognate kind. It seems that to shape hubs with broad forming tools operating back and front, to screw threads with opening dies, to turn and bore sprockets, to mill edges from the turret, besides, much else, one must get American tools. No English machines were performing these operations at the show. The quantity of material removed in a few minutes by forming tools in turning hubs from the solid bar would have been pronounced impossible by any workman half a dozen years ago. But there remains the fact, nevertheless, that the hubs can be turned more cheaply thus than by using drop forgings in which the amount to be removed by turning is slight. So with the recesses in the sprocket wheels; these are perfectly interchangeable, because they are turned by nests of tools arranged somewhat similar to the tools in a boring head.

"In all these machines the bearings are so massive that any sensible wear is practically impossible. The slides are long, and scraped to accurate fits. All is substantial and stable, even though the work done is often of small size.

"There was a goodly collection of light lathes at the Stanley Show. A few were English, most were American. The former did not appear to advantage by the side of the latter. The American lathe has come here to stay. On the whole, it is a good machine; in several respects it is much handier than the English standard type. I am not speaking of the American lathe of twelve or fifteen years ago, but of the machine as it exists to-day. Of these there was a goodly selection, varying widely in design and in detail. Using a very old simile, the English might be likened to the great Spanish galleon, the American to the light English vessels. There are many little details about modern American lathes which may tend to facilitate the work of the turner and screw cutter, while the English lathes are made much as they were thirty years ago. To go into points of detail would occupy too much space, and they are more or less familiar to most users of machine tools.

"Not only in design, but in matters of detail of fitting and finish, the American lathes were superior to most of the standard types of English ones at the show. That does not say that they were superior to the best English machines, but then none of the best English firms were represented there. But if they had been, the American fitting would still have compared favorably with theirs. I tried many of the slides and screws at the different stands, and found the working smooth, easy, just sufficiently free, and without backlash or slop. Better work could not be desired. These were show lathes, but so also were those of English type in the same building, many of which were wanting in some of these details. The best English lathes were those which are made by firms who build in greater or less degree upon American design, and after American methods. The fact that several such firms have grown up in recent years illustrates the adage that 'imitation is the sincerest flattery.'

"In making comparisons at the show, one notices the incompleteness of some of the English tools by comparison with those of American design. This is observable in the friction-geared heads, in the wire feeds, in turret arrangements, in the lubricating apparatus, in stops, in the steadying and centering jigs, by the use of which eccentricity of turned and screwed parts is rendered impossible. The feeding of a flood of lubricant under pressure through the turret center along oil-tubed drills directly to the cutting point, is a nearly recent feature fitted to American turrets. The quantity of lubricant used, mostly expensive lard-oil, would frighten an old-time believer in the drip-can; but then, with tank-beds and trays and a centrifugal separator, the oil is almost wholly recovered and used again and again. The constant flood of lubrication also permits of heavy cutting, while the tool edges are preserved for a long period intact. The use of the turret is not confined so closely to the holding of single drills, reamers and cognate tools as it is with us. Box tools predominate, and these are so constructed that work is easily turned to thousandths of an inch, with true cutting tools, ground and set to correct angles. Though tools of this type are used in English shops, they have not reached so high a degree of development, and such infinite variations, as those sent from America. Exceptions occur in those English shops which are modelled on American lines and methods, such, for example, as the Small Arms Factory, at Enfield Lock. And it is easy to see why the tools endure so long without re-grinding; the rate of turning is not rapid, but there is no time lost, on the one hand, nor tools unduly forced by the introduction of the human element, and the lubrication is most abundant. The numerous milling machines, drilling, grinding and other machines must need be passed without observation. Sufficient has been said to indicate one direction in which English manufacturers have permitted the invasion of foreign machinery in large quantities, and even the English manufacturers go to the American agents for their small tools. At Churchill's I was shown £2,000 worth of American twist drills on shelves. Micrometers, calipers, milling cutters, reamers and all kinds of small tools for working metal and wood were also closely packed in ranges of shelving. There are six agents for American machinery in London alone, besides others in the provinces; and large numbers of machines are ready for immediate delivery. If a machine does not happen to be in stock, it can generally be delivered from America in from three weeks to a month. As regards prices of the ordinary machines, as a general statement, the best American machines cost more than those made by second-rate English firms, but less than those of the best Manchester firms. In reference to design and workmanship, the tools of the best American firms leave nothing to be desired. The Americans have made a point of catering for the English and Continental tool users, and their excellent systems of measurement and templet work enable them to make parts interchangeable. Perhaps it is not generally known that the firm of Pratt & Whitney* undertake the fittings of astronomical instruments as a regular part of their business. Another matter perhaps not generally known is, that while in the United States the rise-and-fall rest is mostly used, the lathes which are sent to England mostly have compound rests. The American lead screw often has five threads per inch. But lead screws of four per inch are supplied, if required for English use.

"Much more relating to the subject suggests itself to the mind, but this must suffice. These lessons of the show should be laid to heart by the great English firms, rich in capital, in prestige, in skill. In other directions there are not wanting indications that English manufacturers will be hard pressed in the near future. But one lesson is enough to learn at one time."

* The best results are obtained here with such machines by having them in charge of skilled men, though not necessarily thoroughly skilled all-round machinists.

* The firm of Warner & Swasey, of Cleveland, probably is meant.

Compressed Air Explosions.

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I have seen in the "American Machin-

ist," at different times, some criticism of the man with the eye-glass, needle-point dividers and fine center punch, and I am quite free to admit that absolute accuracy of distance is difficult to attain in this manner; but with a finely and accurately graduated scale, a good glass and sharp points on dividers and center punch, a degree of accuracy may be attained that is sufficient in a majority of cases.

It is only necessary to turn to back numbers of the "American Machinist" of July 30, 1891, in an article by the late Mr. A. Webster, of the Waltham Watch Tool Company, entitled "A Case of Close Work," describing a job done in connection with work upon the Franklin typewriter, and articles alluding to it, by Mr. Miller, in issues of January 21 and March 31, 1892; also the manner of arriving at such accuracy, by Mr. Bowers, in the latter article, to realize something of the possibilities of close and accurate lining.

It is not to be supposed that ordinary workmen can produce such close results as were realized in this case, and they are not always necessary, and extraordinary workmen have to begin by being ordinary ones first, and no man is any the worse for good tools, increasing his capacity and ability the more he has of them, and the better he learns how and when to use them.

The clamps which hold the points to the jaws can be either milled from solid stock or bent up of sheet steel. A pair is shown at Fig. 2, cut away in the center where they bear upon the points. The bridge with tapped hole for binding screw is first soft soldered to this portion of the clamp and then riveted.

The shoe under each binding screw is fitted to the bridge before the bridge becomes a part of the clamp. This form of shoe is stiff, and stays in place without the need of notching or projecting ends. Probably if used where it had to be moved frequently and to some distance, as upon the top edge of the beam, it would wedge down upon it, and cause the jaw to bind; but in the position shown it does well enough.

Two sizes of shoes are shown of different thickness, at Fig. 6, in order that points may be used with either round or half-round shanks, or with a small flat upon them. A great variety can be made, some of which I show and will describe.

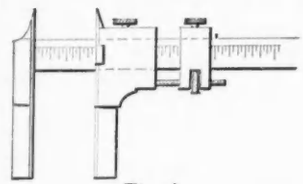


Fig. 1

Fig. 4

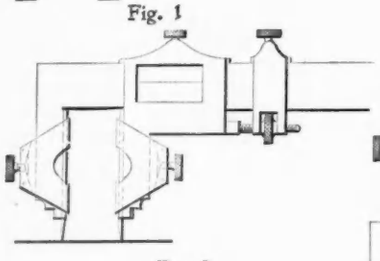


Fig. 2

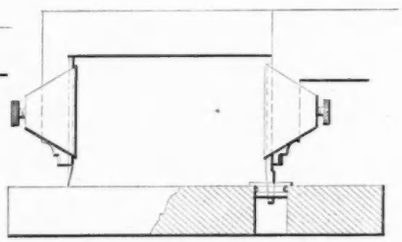
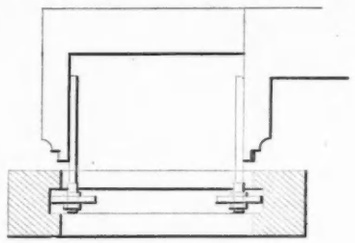


Fig. 5



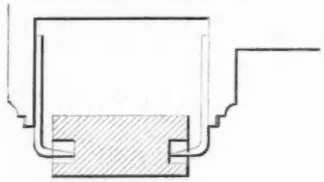


Fig. 7

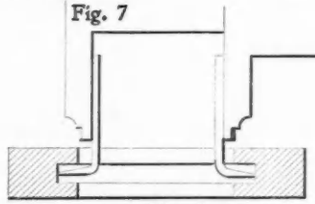


Fig. 8

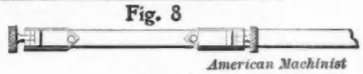


Fig. 9

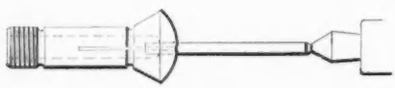


Fig. 3

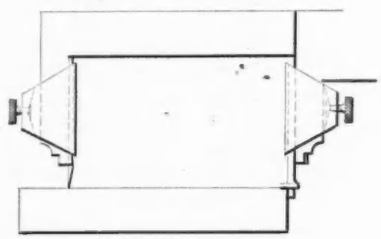


Fig. 6

DIVIDER POINTS FOR VERNIER CALIPERS.

The two half-round points shown in position in Fig. 2 are made from two pieces of drill rod, enough larger in diameter than the thickness of the caliper jaws to allow of holding in manner shown in Fig. 3. I file them their entire length to nearly half their diameter, then harden the points and draw them to a dark purple.

A piece of steel or brass about ¼ inch thick and ¼ inch shorter than the wires—wide enough to stand above the jaws of the vise on the surface grinder, for convenient calipering of the wires at their projecting ends—is placed in the vise, and the wheel run over it until it is properly surfaced. One of the flattened wires is soft soldered upon this finished edge of the piece in the vise, flat side up. The wheel is run over this flat surface until it is true and until the wire measures just one-half its original diameter. The other wire is made like it, and the flat surfaces tinned, wiping off as much as possible of the tinning with an oiled rag. They are then laid flat surfaces together, a bushing slipped over each end and warmed up until they unite. The solder will flow before the color is started at the points, if a little care is used in heating evenly. After cooling, one bushing is rapped off, and the wires with the remaining bushing still in place are pushed into a split chuck from the back end, the bushing being in the enlarged portion of the chuck, and the halved wires projecting from the chuck at its gripping end sufficiently for grinding. They are placed in the bench lathe, and the two projecting ends ground to 60 degrees. They are then removed from the chuck, the bushing ripped off, and the ends upon which it was being held in the chuck, the pointed ends resting in a concave center in the tail stock, enough of the wires being exposed to the wheel for the lengths necessary for points, it is ground to a diameter equal to the thickness of the caliper jaws. The back ends of the wires are now notched on the corner of an emery wheel at the proper distance from pointed ends for the length necessary for points, and broken off; another bushing is pushed upon the wires at this end, and the ends nicely squared off on the wheel. They are again placed in a split chuck in the bench lathe with the bushing still on, leaving just enough projecting from the chuck to grind the ends already pointed to 60 degrees to an angle sufficiently sharp for divider points.

This last bushing used should be saved, to be used in the manner just described for sharpening the points when dull.

With ordinary use, these points should last a long time, and I think it pays to make them well. Points *can* be made very easily and quickly by selecting wire of the right diameter, filing one half away—leaving them round, or only filing a small flat upon them, then grinding points by hand after hardening. Points made in the first manner will give a very close reading to the vernier or caliper scale, however.

A pump center point is handy at times, and I show one at Fig. 4. I make them in the bench lathe, hardening and grinding all over.

In preference to a pump center, I use split bushings with a taper hole in them, fitting the hole I wish to work from, and forced upon a shank that takes the place of a point in one of the clamps upon the caliper jaw (Fig. 5).

These bushings get a good bearing in the hole at a place upon its surface where it is pretty sure to be in better condition to work from than upon its immediate edge, where a pump center would bear, or even upon a surface reamed at this point to conform to the pump center angle. This reaming, if done by a reamer with a guiding point that fits the hole, may be right; but if done with an ordinary center reamer, the chances are that it will not be true with the hole.

Then, again, it often happens that the corner of the hole cannot be reamed off, but must be left sharp when there is nothing to do but to plug it in some way or work from its circumference instead of its center. I have found this bushing scheme to work all right, as the bushing does not turn upon the taper shank upon which it is forced and held by the clamp to the caliper jaw, but turns with the entire caliper in the hole from which you are working; so it is not essential that the taper hole in the bushing be absolutely true with its outside. I make them so, however, as it is little trouble, for I harden the bushings and grind them upon a small taper stub mandrel. Forcing them upon the taper shank when they are split distorts them slightly; but if they fit the hole, there is no need of splitting them, although I find the split bushing a convenience in holes that vary slightly from standard sizes, and the distortion makes no difference in the accuracy of the work, providing the hole is round and the bushing fills it at two points without shake. The bushings are not expensive to make, if one has a bench lathe with a grinding attachment, and a number of standard sizes can be quickly turned out.

I make a handy reamer for small taper holes by hardening a piece of drill rod and grinding it the right taper, as a plug, and finally grinding five flat sides upon it by indexing with the pin and holes in the rim of lathe cone; this leaves sides slightly concave and just in the right shape to be brought to a nice edge with an oil stone laid flat upon them. One or two of the faces can be left without grinding flat, so that a portion of the reamer has a more extended bearing in the hole; this adds some to its steadiness in cutting. Small straight reamers can also be made in this way, and work well, particularly on brass.

For testing or obtaining distances from a given point to an edge, I use a point as shown at Fig. 6. The vernier jaw can be used, but it must be tipped some, and one of the features of either calipers or dividers that I particularly like is that property which admits of their being kept parallel. The vernier or caliper scale can be used in this case by allowing for the diameter of the point at *a*, which should be ground some even size, as ⅛ inch or 3-16 inch.

By using two shanks with bushings, or making bent points as shown at Fig. 7, calipering can be done in various shaped recesses that are awkward to get at with ordinary tools, by first noting the reading on the scale with the points touching each other, and then making the necessary allowance when the caliper is set to the desired size. The points can be turned to point out, if wished, and the caliper jaws closed to some even reading, and the points can then be calipered with a micrometer, and allowance made in reading from the scale. Fig. 8 shows a case where points set in this manner are convenient. When bushings are used, no change in position is necessary, as they are, of course, from the nature of their shape, at once available for either outside or inside measuring, with the proper allowance for their size in reading from the scale. This attachment was designed for an 18-inch or 24-inch vernier, and it will be understood that the nearer the ends of the jaws the ends of the points are, the more rigid they will be; but it is desirable at times to be able to drop either one or both points to some distance, to reach a spot that can be got at in no other way, and with ordinary care this can be satisfactorily done.

When the jaws of a beam caliper or caliper square are thicker than you wish to make the diameter of the shank, that portion of the clamp touching and binding upon the point can be made V-shaped, as shown at Fig. 9, enabling it to hold any size point. I have only described some of the most common points required, but others suitable for peculiar and particular work will suggest themselves, and can be made as required. MACHINIST.

▲ ▲ ▲

A man was recently attending a picker in a mill in a suburb of Philadelphia, when the heavy 4-inch belt broke and wound around the shaft. The flying end struck him with great force in the left side, tearing off his clothing and cutting a terrible gash in his side, from which the covering of the lung protruded. At the hospital he was found to have sustained compound fractures of several ribs and dangerous internal injuries.

Teachings of a Drill Factory—II.

BY JOHN RANDOL.

The work is all at piece rates. The wage for turners is from $10 to $16, or even $18 weekly, averaging perhaps about $12. Each hand runs as many lathes as he can manage, usually three engine lathes and one filing lathe, as each hand finishes his own work from first to last. At first the turners were divided into roughers, finishers and filers, which led to trouble at once because no one hand was responsible for all the turning done on any one drill. On taper shank drill blanks one hand attends five lathes, and roughs and finishes the taper shanks and roughs the drill bodies. Two of the turners nearly double the work of any of the others, owing to long experience and quickness of movement. Work is so given out as to keep each man as nearly as possible on the same work constantly. In turning the taper shanks the workman gages the first piece after grinding and setting his tool. The taper attachment makes the angle always correct, for succeeding pieces turned with the same tool—setting a cut is taken over the shank without gaging, the blank is taken out of the lathe and the carriage is run back by hand and another blank is placed on the centers and turned without touching anything, and so on until the tool requires change, thus producing very nearly uniform work so long as the tool edge holds good. The taper shanks are finally finished in the hand lathe by filing and chalking with a taper socket gage, in the usual tool-making manner.

All drills are tapered from a third to a half a thousandth per inch of length to make them clear properly, and in turning the depth of roughing cut is 1-64 inch on a side from ¼ to ¾ inch diameter, 1-32 inch from 25-32 inch to 1 11-32 inches, and from 1 11-32 inches up the cut is 3-32 on a side, to remove the inevitable outer shell of tool steel bars partly decarbonized by exposure to the air while hot. The surface speed in the lathe is from 35 to 47 feet for roughing cuts, average 41 feet, and for finishing cuts from 37 to 53 feet, with an average of 45 feet. The workmen establish the best speed for each new lot of blanks by starting low, and raising the speed a cone step at a time so long as the tool holds its edge. The feed is fine, from 120 to 140 turns per inch.

Steels of the same analysis give very different results in the turning lathe, owing to differences in annealing probably, although the utmost care is taken to have the annealing uniform. For annealing the blanks are packed with milling chips in wrought iron tubes 4 and 6 inches diameter, with caps screwed on. These packed tubes are placed on the annealing furnace in the morning, and raised to full heat by noon; the oven is then closed until the tubes are black red, and the tubes are finally drawn from the oven at night and left to cool in the open air. Pyrometers

have been used in the annealing furnaces, but are not thought to give results superior to those obtained from skilled visual observation. The greatest care is used to avoid overheating in annealing.

With the most careful annealing of stock a lathe tool which will stand up to rough 25 drill blanks an inch in diameter and 11 inches long in one lot of blanks,

Fig. 16. BURRING DRILLS ON THE VICE.

may have to be ground for every such blank in another lot. The tools most approved for rough turning the drill blanks are of self-hardening Mushet steel, tempered by heating red hot and cooling in an air blast from an ordinary fan.

The finishing cut is about 0.005 inch on a side. This small depth of cut is greatly in favor of tool-edge endurance, the lathe tools covering about twice the surface before grinding in finishing cuts that can be covered in roughing cuts.

The principal fault in the drill rod is a seam which is difficult to cut, acting like the "sand seam" in wrought iron, with which old-time shafting turners were so familiar. There is no sand in the drill blank, but the hard seam, though of clean metal, makes a distinct ridge in the turning, and the blank which shows this seam is at once thrown out, at the expense of the steel maker.

The drill blanks are finished under size, to allow for a constant expansion of the drill diameter in hardening, caused by an untwisting movement which spreads the drill lips apart. This is allowed for according to the following table of average expansions, made up from an extended series of actual tests:

	Inch.
¼-inch drill diameter expansion	0.0004
½-inch drill diameter expansion	0.0012
1 -inch drill diameter expansion	0.0022
1½-inch drill diameter expansion	0.0029
2 -inch drill diameter expansion	0.0035

On the shortest blanks one hand can run two engine lathes and a filing lathe; on larger sizes, three engine lathes and a filing lathe. The files used in filing drill blanks are 12-inch "mill files," float or single cut. In the operation of filing blanks, the tools used, beside the file, are a wire file brush, bench micrometer, snap gage and the hand micrometer. The snap gage is used for testing while filing in the lathe, and also for gaging after the blank is taken out of the lathe. Although the blank is tapering, the taper is very small, and the workman uses the snap gage all over the blank body, his great experience enabling him to judge the taper very closely by the shake or twist of the snap gage on the work in process of filing. The bench micrometer has its screw fixed to the required size of the point of the drill blank, and when the filed blank is taken from the lathe, the workman tries the snap gage on it, and then passes the point of the blank through the bench micrometer, and finally measures it all over with the hand micrometer, making the readings with care.

At first sight, it might seem that the workmen measure the blanks with needless caution; but as the blank-turning is piece-work, and the hands can take any method they please to produce blanks that will pass inspection, it is wholly unreasonable to suppose that they do any needless work, either in gaging or anything else. The final reading with the hand micrometer tells the workman exactly what he has produced, and lets him know what he has to expect from the final diameter test made by the foreman of the turning department, who measures each and every drill blank produced by his men with a hand micrometer, taking the sizes at each end and the middle of the blank body.

Fig. 17. OIL DRILL.

The final operation before grooving is "tanging" the taper shank blanks with straddle mills in a Lincoln milling machine. The cut is very short, and the workman has just time to burr one tang with a hand file, as shown in the engraving, before he has to place another blank in the milling machine vice.

After grooving, there is a small burr turned up on the following edge of the groove. The action of the spiral feed and the direction of mill rotation cut the leading edge of the land perfectly clean. This burr must be removed to enable the grooved drill to go into the body clearing bush, which has to be a very close fit, to support the drill with the accuracy required for such a small cut. For the wire sizes, this burr is removed in the hand-lathe, the Brown & Sharpe knee-action, draw-back collet filing lathe being used. Larger sizes are burred on the vise, as shown in Fig. 16, much more rapidly than might be supposed, the drill being rotated by the left hand, so that the file follows

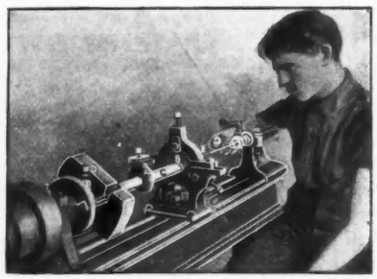


Fig. 18. DRILLING LONG HOLES IN OIL DRILL BLANKS.

the spiral edge exactly. As the burr is all on the following edge of the land, the leading edge need not be touched by the file in burring, and the file work on the following edge is removed by the clearing-mill cut, so that the drills finally go out with absolutely no hand-worked surface on them.

"Oil drills" are drills which have an oil hole in each land, following the spiral, both of these long small twisted holes opening at one end close to the cutting lip of the drill, and at the other end into a larger hollow in the drill shank, all as shown in Fig. 17, so that the cut may be lubricated with oil supplied to the drill shank under pressure varying from 40 or 50 pounds to two or three hundred pounds to the square inch, according to the work. This pressure lubrication vastly increases both the output of work and the life of the drill, and those once accustomed to the high production of the oil drill will not cheerfully use ordinary

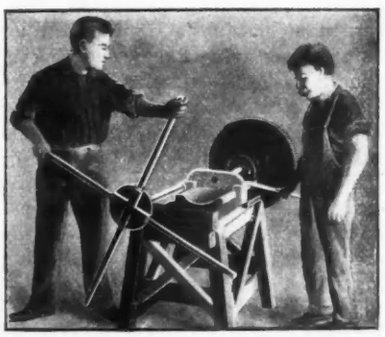


Fig. 19. TWISTING OIL DRILL BLANKS.

lubrication, and although these oil drills, which are covered by a late patent issued to Mr. Rickey, chief draftsman of the T. & B. Co., are very expensive, their use is rapidly increasing in shops where drilling tough metal like drop forgings is a constant operation. In drilling deep holes

it is almost impossible to carry oil to the cut, as is well known. But with the oil drills not only is the oil delivered at the actual cutting point where the chip is severed from the stock, but the chips are forced out of the hole, no matter what its

Fig. 20. CENTERING AND STRAIGHTENING TAPER-SHANK BLANKS.

depth, and the holes are also more certain to be straight when drilled under forced lubrication.

The holes are drilled in the rough-turned oil drill blanks on hand lathes, the drill blank being rotated by an eccentric chuck, and the slender drill being held in an Almond chuck in the tail spindle, and fed by the tail-stock screw, the tail stock being pulled back very frequently to clear the chips. There is nothing rapid about this operation, which is shown in Fig. 18, but it is better than any other method yet tried. The small holes must be straight in the blank, and rotating the drill blank, held in the ecentric chuck and revolving eccentric bush in the steady rest, balanced as shown in the engravings, is the only way so far found, by which these straight long small holes can be made. In Fig. 18, *D* is a driver having an eccentric live center for the shank end of the oil drill blank, *C* is the blank in process of drilling, *A* is the

Fig. 21. TESTING DRILLS ON A SURFACE PLATE.

counterbalance, *B* is the revolving eccentric bush in the steady rest. The operator sits with his hand on the tail stock clamping lever, and most of his time is taken up with loosening the tail stock, drawing it back, brushing the chips off the long drill, oiling the drill and sliding it up to its cut in the blank. When the drill point touches the bottom of the hole the tail stock is clamped to the lathe bed and the drill is fed forward a very little way with the tail stock screw, and again withdrawn. Mr. Rickey is looking for a more rapid method, but has a wrinkle between his eyebrows when he talks about the job. It is one of those perfectly simple but extremely difficult jobs which are made almost hopeless by proportions and conditions which cannot be changed.

From the drilling lathe the oil drill blanks go to the nicking machine, Fig. 13, where they have the driving nick cut in the shank end. This nick must have a definite location in regard to the oil holes, because the holes are to lie in the lands of the drill after the spiral grooves are cut, hence there must be a correctly located "spot" somewhere on the drill blank by which the blank can be located in the blank twisting machine and in the grooving machine. An angle plate is bolted to the plate *S*, Fig. 13, the top edge of this angle plate, which is outside of the

Fig. 22. HEATING LARGE DRILLS FOR STRAIGHTENING.

length of the oil drill blank, is exactly half the diameter of the small oil holes in the blank below the center of the V in the vise jaw, and two wires which fit the small oil holes are slipped into them, and lie on top edge of the angle plate while the V-vise jaw is screwed up to hold the blank for nicking; by this means the nick is cut in a fixed relative position to the oil holes. If the oil drill blanks are taper shank, and so tanged instead of nicked, the tanging is spotted off the oil holes, in the same manner.

From the nicking or tanging machine the oil-drill blanks go to the smith shop, and are heated red hot, and then placed in the twisting machine, shown in Fig. 19, where the blank is twisted to bring the small holes to the same spiral which is afterward to be cut in the blank by the grooving machines. The twisting is done with care, but the operation is under perfect control, and is speedy, and the spiral given the holes in the blank is so nearly correct that it is a very rare occurrence for the grooving mills to cut into the small oil holes. When this does occur, the job is spoiled and must be thrown away.

In the grooving machines the twisted blanks are "spotted" by the nick or the tang of the blank, as may be. Before grooving, the oil blanks go to the turning room, and are turned and filed to finished size, the small hole drilling and

Fig. 23. TESTING STRAIGHTNESS OF TAPER-SHANK DRILLS.

twisting being done after the blank is rough turned.

The forge-shop does not have a very large part in twist-drill making. The annealing is done there, a Brown & Sharpe furnace being used. The taper-shank drills are forged there, on a Bradley hammer. The dies used are mostly "choke" dies, and the small tit on the blank is cut off on the press. The shank-forging and oil-drill twisting are the principal forge-shop operations.

After forging, the taper shank blanks are centered with the aid of a bench centering machine, as shown in Fig. 20. The straightening is done in the hand screw press, seen in front of the workman. The only unusual feature of the operation is the use of the white muslin screen *S*, placed between the window and the workman's eyes, same as in the other drill-straightening operations.

Fig. 24. STRAIGHTENING SMALL DRILLS.

After hardening and tempering, the drills are almost all crooked, and must be straightened by heating and bending in the hand screw press for the large sizes, or in a hand lever press for the

smaller ones. All of these operations are carried on in darkened rooms, screens and curtains being so arranged as to throw comparatively faint beams of light where light is needed, the general gloom making these faint lights as effective as a very strong light would be under or-

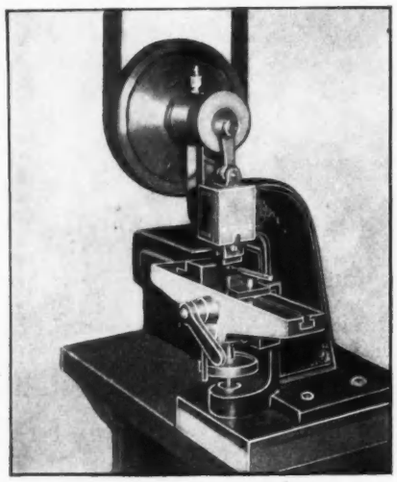


Fig. 25. TESTING PRESS.

dinary conditions. The faint light thrown on the surface plates on which the drills are rolled is ample for the visual test, and is far less trying to the eyes of the operators than a strong light would be. Fig. 21 shows the straightener at work. A geared hand-operated screw press *A* serves to bend the heated drill. Just beyond this screw press a taper-shank drill-testing machine is seen. The workman is shown in the act of rolling a small straight shank drill on the eye-high surface plate, the drill being held with a pair of ordinary cutting pliers, as it is hot. The room has been lightened to permit taking the photograph. The drills are heated before being subjected to bending pressure in the press, as they are so hard that, at normal temperatures, they would break before bending sufficiently to "set." They are, of course, not heated enough to start the color, but even this low degree of heat makes them take a "set" from the press very readily. The workman rolls the drill on the surface plate, watching the line of light between the drill and the plate; if not straight, the drill is again heated and placed under pressure on the high side; if straight, the drill is let go and rolls back off the slightly inclined surface plate into a receiving box at the rear.

Fig. 22 shows the heating of the drill in a gas flame. This gas flame is regulated by a treadle, and is only used for an instant at a time. Fig. 23 shows the testing of shank drills for straightness, by placing them in a taper socket spindle which is revolved by the left hand, while the testing index is moved along its supporting rod by the right hand of the workman.

Fig. 24 is a reproduction of a flashlight picture of a workman straightening small drills. The picture caught the workman in the act of sweeping the drill through the gas flame. The flames are very large, so as to act at once on the whole length of the drill, and the drills are held in the flame for only a very small fraction of a second. The small lever press on which the straightening is done shows the end of its lever to the left of the gas-jet hood.

Fig. 25 shows a special press with a micrometer screw table adjustment, in which the drills are given a test deflection, cold, in two directions. If the drills are too hard, this test deflection breaks them. If they are too soft, the drill takes a set. This test is applied to a few drills of each lot, selected at random. If all the test drills pass successfully through the deflection test, the lot is passed as good. If any fail, more are put through the test, and if 20 per cent. of the lot fail, all are condemned and thrown away, as too unreliable to be sent out.

Some users order drills with no variation limit, and such orders are filled by grinding the drills on the Brown & Sharpe universal grinder, after they are straightened. It is difficult to understand the utility of the "no variation" twist drill, since the twist drill can never make a hole exactly its own size, and a quarter thousandth limit would seem close enough for a rough drill operation. But drills are constantly ordered exactly to size by

Fig. 26. WIRE BRUSHING FINISHED DRILLS.

users who are ready to pay for such tools; hence it is only fair to assume that there is real economy in the use of dead-to-size drills for some special purposes.

The last cut on the drills is made in grinding the lip clearance by hand. Experiments have been tried with all the drill-grinding machines, but nothing gives results comparable with the hand work, either for finish or economy. Undoubtedly, the elastic support given by the hand of the workman is the thing lacking in the machines; besides this, placing in the drill holder and taking the drills therefrom takes too much time.

The final finish is given to the drills by brushing them all over with a rapidly revolving wire brush and oil, as shown in Fig. 26, the wire brush being mounted on a polishing machine spindle and partly surrounded by a sheet-iron hood, leaving the boy room to roll the drills against the under side of the brush. Wire brushing in oil forms an important step in some sporting gun barrel operations, and it gives the twist drills a uniform gray-black color which is not easily removed by handling, and resists rust to a considerable degree.

The last thing of all is to give a few drills from each lot an actual cutting test in the material they are to drill, in a large drill press.

All of these twist drill operations have been carefully described and fully illustrated, because the processes are calculated to give those who are familiar with the ordinary machine shop only an entirely new idea of what is needful to produce work of nearly uniform sizes, and because the straightening operations can be performed by any tool maker as he may require in the ordinary course of his work. Some of these processes have never before been described in print, and so are of general interest, but the great lesson of the twist drill shop is care in measurement, and distrust of any single measurement made by one man with one measuring instrument. The body turners do not depend on the snap gage measurement, nor on the bench micrometer measurement, but follow those usually considered sufficient tests with the hand micrometer.

Again no stock is taken as good on the strength of the physical test. The analysis may be according to specification, and yet the stock may not make good drills, hence the analysis is supplemented by fracture inspection, and each individual lot of drills is watched all the way through the shop, and any indication of unusual behavior at any stage of manipulation results in immediate and rigid tests.

What would be thought of a lathe hand in an ordinary shop who used a snap gage, a bench micrometer and a hand micrometer to measure each piece of his work? Yet the drill blank turners do this at their own expense, because by so doing they can earn more money for themselves, that is to say, can turn out more work that will pass inspection in a given time.

Take nothing on trust, neither stock, tools nor labor; question all things and hold fast only to that which contains within itself the evidence of its own goodness and truth; such is the lesson of the drill shop, and it is a lesson which if heeded in more of our machine shops would do away with many of the worries of the foreman's life.

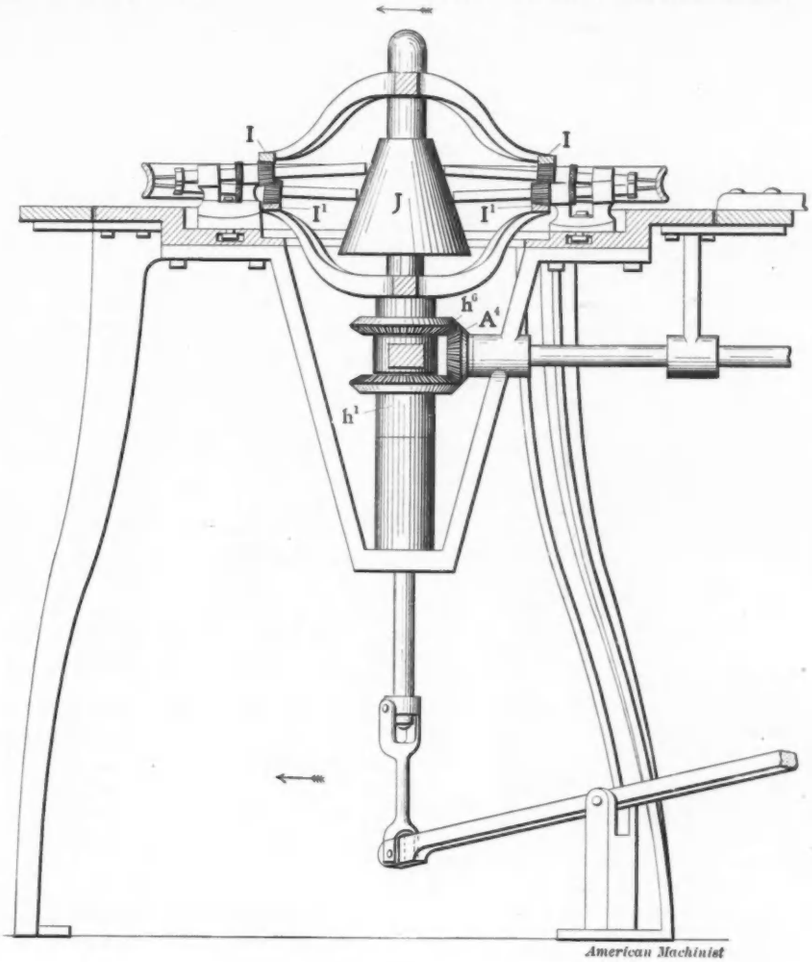


Fig. 2

MULTIPLE SPINDLE DRILL.

Multiple Spindle Drill for Bicycle Rims.

The drill shown in the accompanying cuts is another outgrowth of and contribution to the bicycle industry. It drills simultaneously all the holes of a bicycle rim, except that for the tire nipple. Fig. 1 is a plan and Fig. 2 an elevation, partly in section, showing the essential parts of the machine. The holes are drilled radially and from the interior of the rim. The rim is clamped concentrically upon a horizontal circular ring plate or table. A lower and inner circle of the same table holds the stands for the drill spindles. Each drill spindle is mounted upon two bearings, Fig. 3, the casting comprising them having a curved foot and fitting in a corresponding shoe, which allows the spindle to be tipped to the proper angle. The outer bearing fits the drill spindle itself, while in the other bearing there is a sleeve splined to the spindle which carries a small bevel pinion on its inner end, the sleeve and spindle being driven by this pinion, while the spline allows the spindle to move endwise through it. As the alternate spokes of bicycle rims, and consequently the holes for them, are at different angles to the central radial plane, the drills naturally divide into two equal sets, one set being driven by a large bevel wheel T below the spindles, and the other set by a similar wheel I above the spindles. The power comes through the horizontal shaft with the bevel pinion A^4 on its inner end. This pinion drives the two gears spoken of, the lower gear T being driven directly by the small bevel wheel h^6 attached to it. The small lower bevel gear h^1 connected with the driving pinion is keyed to a vertical sleeve which has upon its upper end the other gear I for driving the other set of spindles. Although these

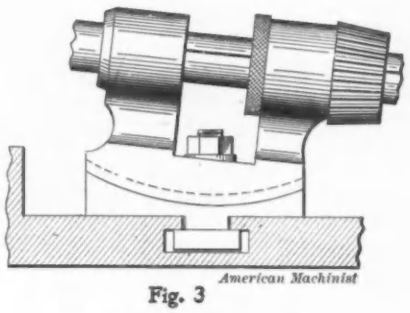
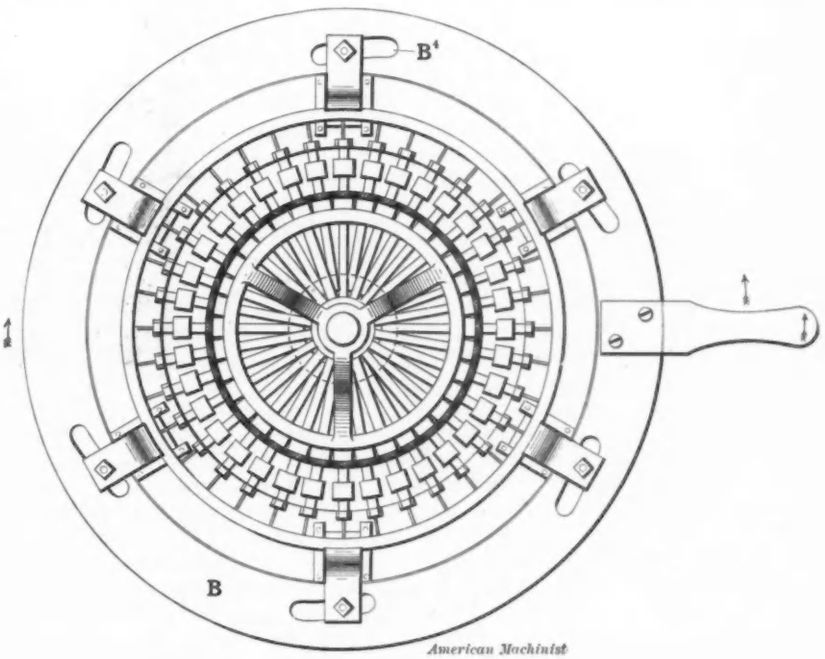


Fig. 3

ONE OF THE SPINDLES.

large gears turn in opposite directions, the drills all turn the same way, on account of one-half of them being driven from below and the other half from above.

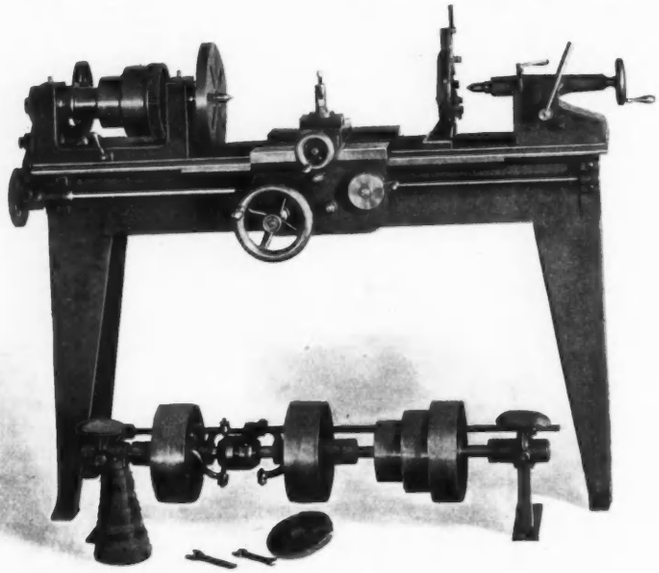
The inner ends of the drill spindles are normally in contact with the cone J, and when this cone is moved upward by the action of the treadle below, the drills are fed outward and the rim is drilled. The description received tells us that when the cone is dropped the spindles are to be pushed back by hand; but it is evident that a little helical spring upon each would be much better for the purpose. The central spindle, gears, etc., have, of course, a second bracket between the small gears



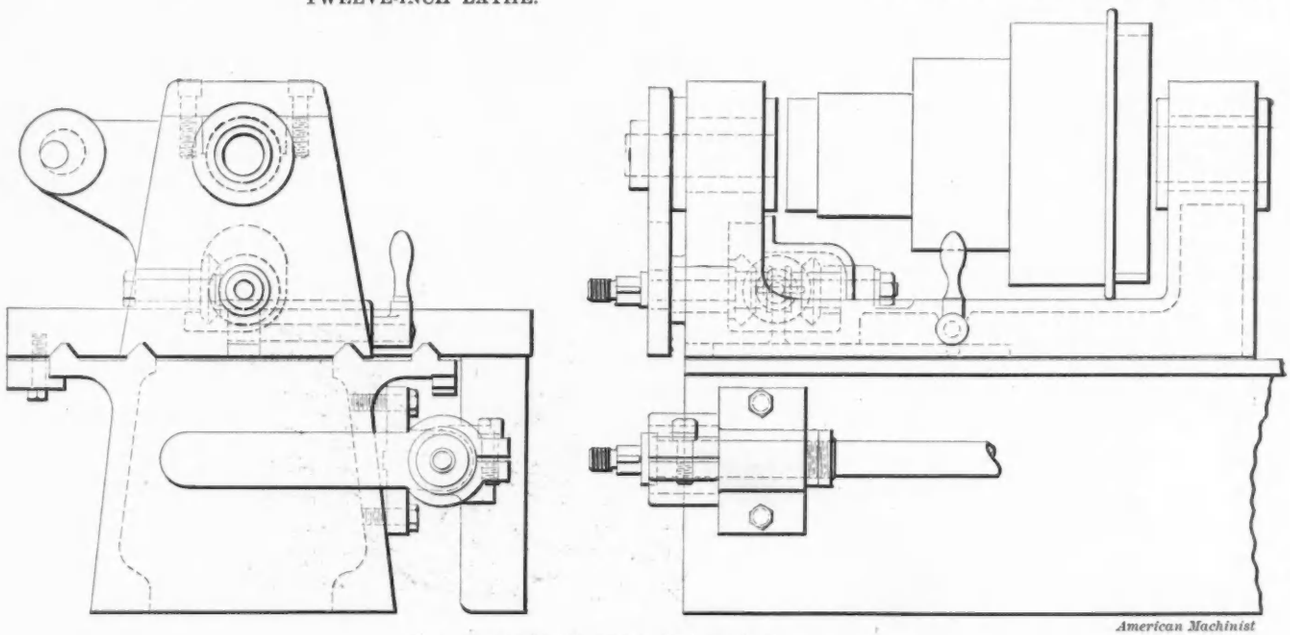
MULTIPLE SPINDLE DRILL.

for the purpose of keeping all in position.

Referring to Fig. 1, it will be noticed that there is a large movable outer ring *B*, having the slots B^4 and the handle B^1. The movement of this ring sets the dogs in for clamping the rim to be drilled, and a movement in the other direction moves the dogs outward and releases the rim. The inventor of the drill is John Icely Warman, Chicago, Ill.



TWELVE-INCH LATHE.



FEED REVERSING DEVICE.

American Machinist

A New Twelve-Inch Lathe.

We give herewith some engravings of a lathe which, reversing recent tendencies in lathe construction, has been designed to be as simple as possible, in view of its intended functions—i. e., to do ordinary turning and screw cutting rapidly and well.

Though so simple in appearance, the lathe, nevertheless, embodies some features of interest; especially in the plan adopted for obtaining the feed motion, which, though not new, is unusual.

The feed-rod is dispensed with, and the lead screw is splined for the friction feed; the arrangement of gearing for driving the screw being shown best in the outline engraving, Fig. 2. The gears *A B* drive the sleeve *C* and bevels *F*, F^1 and F^2. Spindle *D* is fitted freely in sleeve *C*. On this spindle is keyed a clutch *E*, which engages with clutches on either F^1 or F^2, when lever *G* is thrown forward or back. Clutch *E* is splined to shaft *D* to give feed gear either right or left hand motion. When the feed is not used the lever is set centrally. The lever is used for reversing the carriage motion only in screw cutting, this being usually preferred, rather than reversing the countershaft.

From the stud the usual change gears transmit the motion, and by changing gears *A* and *B* to a ratio of 2 to 1, instead of even, all threads are, of course, doubled in pitch.

It will be noticed that the foot-stock is provided with the spindle-supporting projection so strongly advocated by Professor Sweet, and the lathe is, in fact, designed, not for tool-room work, but rather for the plain work of the machine shop and manufactory. The lathe swings 12 inches diameter over the bed. The cone pulley is for a 2½-inch belt, and by properly arranging the line-shaft pulleys, a total of twelve different speeds are obtained. This lathe has been brought out by Hill, Clarke & Co., Boston, Mass.

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Letters from Practical Men.

The Monkey, the Stone and the Cord.

Editor American Machinist:

The question raised in your issue of December 9th, as to "What Puzzled the 'Eminent Physicists,'" is not a deep one, but contains an interesting problem in inertia which has baffled many an amateur philosopher, and it may be well to look at it from a mechanical standpoint.

To state the question concisely, we suppose a cord over a pulley, with a monkey clinging to one end and a stone of exactly the same weight as the monkey, attached to the other. If the monkey proceed to climb the cord, what will happen? Will the stone rise or fall?

Now, supposing the cord to have no weight, the pulley attached to a stationary point and no friction anywhere, so long as the monkey remains quiescent, there is a perfect balance and no motion. But the moment the monkey proceeds to climb, he must pull on the cord, not only enough to sustain his own weight, but

also enough to overcome the inertia of his body, and this additional pull will, in a sense, disturb the balance, and the stone will also begin to rise, and, strange to say, it will, so far as vertical motion is concerned, exactly imitate the monkey.

If the monkey rise slowly, the stone will also rise slowly; if he rise rapidly, the stone will do likewise; if the monkey descend, down goes the stone. If the monkey stop short after a very rapid ascent, the inertia of his body will more than overcome its weight for a moment, and cause a little slack cord above him, which we would suppose, at first sight, would give the stone a chance to fall. But this the irresistible law of inertia will not allow it to do, but it will, so to speak, jump a little in the air in exact imitation of the monkey, and thus leave the same amount of slack on both ends of the cord. In short, if the stone is on the same level as the monkey, to start with, it will always keep even with him, no matter how much cord the monkey may draw in or pay out.

We do not know whether these peculiar motions have anything to do with the common expression about "cutting up monkey shines," but one thing is certain, there is no "monkeying" about the law here exemplified. J. C. GREEN.

Hackettstown, N. J.

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The Reproach of Cheapness.

Editor American Machinist:

While double-acting words are often handy to have, their facility sometimes seems to defeat the purposes for which language is supposed to be employed. The word "cheap," for instance, is constantly made to convey two very different, if not opposite, meanings. A thing may be cheap simply because the price is absolutely low, and regardless of its intrinsic value, or it may be cheap because its price is low, as compared with its actual practical value. Regardless of the double use of the word, it has been and is still widely used as a term of reproach and of depreciation. It was, of course, our English friends who got up the expression, "cheap and nasty," and they are welcome to use it. It does not fit our language nor our products. The implication that the two adjectives are natural consorts is entirely unwarranted. I am beginning to think that the time is coming, if, indeed, it has not now fully come, when the word "cheap" shall have lost its last trace of presumptive reproach. I am not sure but that "cheap," as applied to our products, carries with it more presumption of excellence, of elaborate preparation of agencies, of minute and exacting supervision of operations, of persistent insistence upon satisfying high standards, than any other word which we have. I do not say that things may not still be cheap and bad, but the badness must cause the cheapness, rather than the cheapness cause the badness.

Probably no one article of common mechanical use, at least none so small and apparently so insignificant, has had so much thought employed in its development and continual improvement, and has had so many facilities employed in its multitudinous production as the monkey wrench. Monkey wrenches are cheap, or low in price, and they are at the same time wonders, not of worthlessness but of usefulness, of value, of excellence in wrenching facility. They are cheap as a consequence of the persistent efforts not to make them cheap, but to make them good. The producers who set out in quest of the cheap alone are never the stayers. The successful quest is always for the production of the good article, and the most successful and lasting quest is for the production of the best.

These wrenches are of great variety of design. Some of them consist of but two pieces of metal; some very good ones have but three pieces. I was looking at and admiring one a day or two ago, which had four pieces, all told. There was the main piece of the wrench, comprising both the head and the handle, with teeth at the back of the shank for the worm to engage. Then there was the sliding jaw, the worm setting between two ears at the back of it, and a screw passing through the lower ear and tapped into the upper one, with a straight part between on which the worm turned smoothly. The wrench was light and strong and without shake, finished and case-hardened all over, and smooth and pleasant to handle; it was, in fact, one of the standard wrenches of one of our best known manufacturing concerns.

These wrenches, and many similar articles of manufacture, are now sufficiently familiar to all of us. How many of us realize the fact that no single living man could make one of those wrenches? No one man could make a wrench precisely the same in shape, in detail of finish, and in general appearance, nor a wrench in all respects as strong and reliable, no matter how much time he might put on it, or how much money he might be paid for it. No purchase price however high could have the effect of concentrating in one man the range of ability required. This may be a rather big assertion, but there can be little doubt about it. The price of a single meal will buy the wrench, and yet no one man can carry all the skill which produces it. We can even narrow down the task. We can assume the wrench to be already designed, an operation extended over a century, and which thousands have helped at. We can assume the model wrench before the man, also the precise material at hand, the shopful of special tools and facilities all ready, and we do not even then know where the man can be found competent for all the operations involved.

An outsider cannot enumerate all the mechanical operations involved in the production of the wrench. Some curious operations about it we can only guess at. In drop forging the main piece out of a straight bar, there is some little trick about getting the stock for the head all right. After the sliding jaw is roughly dropped, there is another trick about forming the hole where it slides over the shank, then other tricks occur all the way along. On the shank and the sliding jaw alone at least the following operations must come in: Drop forging, punching, annealing, milling, grinding, buffing, tumbling, drilling, tapping, case-hardening, and perhaps a little chipping in the earlier stages and a little filing in the latter. The screw is a simple screw-machine job, while the worm requires an automatic machine with some special devices, or two or more operations may be involved in its production. Now, anyone knows that no man in the shop, even with the tools all standing ready adjusted and waiting, could go around and do all the various operations correctly, if at all. The man at each machine or furnace, or what not, is more or less a specialist, and the special training and skill brings both perfection and cheapness, but evermore narrows the successful and profitable range of the individual worker. The true cheapness, the liberal value for the price, has always been brought about by seeking, primarily and constantly, perfection of product. Facility and rapidity of execution, the essential conditions of cheap production, have inevitably followed, and the user, in the long run, has always reaped the benefit.

TECUMSEH SWIFT.

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Cooling Water by Re-expanded Air.

Editor American Machinist:

I have just been looking over some back numbers of the "American Machinist," and was interested in your answer to question No. 115, July 22, 1897. I had a little experience last year in the use of compressed air for cooling purposes, and although I did not get any satisfactory results, my experience would tend to show, as you point out in your answer, that a large volume of air is necessary to cool a small volume of water. I had undertaken to make some experiments on the tensile strength of metals at low temperatures, and having seen it stated in the "American Machinist" that air at 80 pounds gage pressure and at 80 degrees Fahr., expanded to atmospheric pressure, would have, after expanding, a temperature of — 126 degrees, I resolved to try it. The air, in the experiment which I made, was compressed to 80 pounds gage pressure by a Westinghouse air-brake pump, flowing from pump to a reservoir, and from this reservoir it was piped a distance of some 30 feet through a ¾-inch pipe; from here, for a distance of about 6 feet, through a ¼-inch pipe into a small

box about 10 inches by 4 inches and 6 inches deep, which was filled with water. The pipe was placed in the box in the form of a coil whose end was closed, the air being allowed to escape through a number of small holes into the water, the area of these holes being at least equal to the area of the pipe. The lowest temperature attained was + 53 degrees, the initial temperature of the water being 72 degrees. It took, if I remember rightly, about a quarter of an hour to cool this small quantity of water (a little over a gallon) to 53 degrees.

RICHARD E. CHANDLER.

University of Nebraska.

[Our correspondent is far from the first who has been disappointed in trying to cool water by the use of compressed air. More disappointment than anything else has probably been thus far realized. We would have been glad, in this case, to have had a little clearer idea of the volume of air used, and some assurance that it had been brought to as low a temperature as possible at the moment previous to the expansion. It is essential that the expansion should be as free and sudden as possible. If the air is released like the exhaust of a steam engine into a refrigerating chamber, it is probably nearer the correct way of doing it. The use of the ¼-inch pipe by our correspondent, just before the expansion, may have had the effect of heating the air more or less by friction. The discharge of the air up through the water must have stirred it up, so that at the surface, where it was exposed to the external atmosphere, it could be re-absorbing heat even while the cooling was going on. If the letter above shall encourage some others to tell us of their experience in trying to cool water by the use of compressed air, it will serve a useful purpose.—Ed.]

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Figuring Change Gears for Screw-Cutting.

Editor American Machinist:

There are in use several methods of calculating the change gears on a lathe, some better, some worse, and it seems to me that those given in answer to "A. C.," in the "American Machinist" of November 4th, belong in the latter class.

In the first case, that of the simple geared lathe, you say, "Select some gear for the screw," and after explaining to "A. C." how to perform the rest of the calculation, you kindly suggest that if the result is a fractional number, or if it does not represent the number of teeth in any gear in his possession, he may try again.

The rule given for the compound-geared lathe has the same fault; but in this case it is much worse. Think of "selecting at random" three of the four gears to be used, and going through a rather long calculation every time to see if they were the right ones! In choosing two gears out of a set of thirteen, it would be possible to make 156 different combinations; with three to select he might arrange them in 1,716 different ways, and it would be nothing to the discredit of "A. C." if, after making 200 or 300 attempts with your rule, he should apply to the boss for some more definite information. Indeed, it is quite possible that the boss would get around before he had tried it more than a hundred times or so and tell him what gears to put on, thus ending his trouble for the time, and perhaps, if he happened to be in a very good humor, and the job was one of those bonanzas which are paid for by the hour, he would get a piece of chalk, brush off a place on the bench, and give "A. C." a practical lecture on how to gear up a lathe.

First, he would explain that the change gears on a lathe are usually so designed as to be all multiples of some number, and that that number, or some multiple or divisor of it, should be used in any multiplication which is to result in a product equal to the number of teeth in one of the gears. For instance, if the gears are 28, 35, 42, 49, etc., then 7 is the number of which all the gears are multiples, and either 7 or some multiple of it, as 14 or 21, or some divisor, as 3½ or 2⅓, must be a factor in any multiplication the product of which is to equal the number of teeth in one of the gears. Then for a simple geared lathe he would give a rule like this:

Multiply the number of threads per inch of the lead screw by the number of revolutions of the spindle required to turn the stud over once, and write this product under the number of threads per inch of the screw to be cut, in the form of a fraction. Mulitply both terms of this fraction by the same number (this will be the number of which all the gears are multiples or some multiple or divisor of it); the numerator of the resulting fraction will be the driven or gear on the screw; the denominator, the driver or gear on the stud.

For a compound-geared lathe he would stuff him with this:

Produce the first fraction as in the previous rule. Separate this into two fractions which, multiplied together, will reproduce it, and multiply both terms of each of these fractions by the same number, using different multipliers for each fraction if desirable, but multiplying both terms of the same fraction by the same number. The numerators of the resulting fractions will be the driven, the denominators the driver gears. Then he would give him a few illustrations in this manner:

Having a lathe the spindle of which revolves twice while the stud turns over once, with a lead screw of 4 threads to the inch and a set of gears containing all the multiples of 7 from 28 to 112, inclusive, to cut a screw with 32 threads to the inch:

$$\frac{1}{8} = \frac{1}{4} \times \frac{1}{2}. \qquad \begin{matrix} \frac{1}{4} \times 28 = \frac{28}{112} \text{ driven} \\ \text{driver} \\ \frac{1}{2} \times 42 = \frac{42}{84} \text{ driven} \\ \text{driver} \end{matrix}$$

To cut screw with 50 threads per inch:

$$\frac{50}{8} = \frac{5}{2} \times \frac{10}{4}. \qquad \begin{matrix} \frac{5}{2} \times 21 = \frac{105}{42} \text{ driven} \\ \text{driver} \\ \frac{10}{4} \times 7 = \frac{70}{28} \text{ driven} \\ \text{driver} \end{matrix}$$

He would probably wind up the lecture by explaining that it would not be necessary more than once to "multiply the number of threads per inch of the lead screw by the number of revolutions of the spindle required to turn the stud over once," as in subsequent calculations he could consider the product thus obtained as the threads per inch of his lead screw, and use it as the denominator of his first fraction; that if he wanted any information about fractional threads, he could get it by studying the latter part of the editor's answer to his question, and that he had better continue to take and read the "American Machinist," as he could get more practical information out of it than could be had anywhere else for the same money, even if the editor should sometimes give him a poor rule.

LATHE HAND.

[The answer referred to is a standard one which we have reprinted once in each volume for several years. It is intended to be stated in terms as general as possible so as to cover any possible case. In actual use it is, of course, by no means necessary to make as many trials as "Lathe Hand" claims, and the rule is not in point of fact a poor one, but a good one, considering that it is intended to apply to any lathe.—Ed.]

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Micrometer Cuts for Files.

Editor American Machinist:

In your issue of November 25th, Mr. J. Schauring, in referring to an article of Mr. Tecumseh Swift, asks how the theories of said article apply to files. In doing so he gives a little example, and then says, "Why?" Now, in the article of Mr. Swift, the cutting tools referred to are all worked by applying quite a large power in forcing the tools to cut, while the power applied to a file is limited to the amount of pressure the man who does the filing is able to apply. The cutting power is also limited accordingly, consequently a file with many small teeth, each tooth doing a little, will take hold of the "blued steel," while a large file with few teeth, each tooth having to do too much to accomplish any result at all, will slide over the material without any mark left,

because the pressure is not large enough to make the large teeth take hold. Still less could be done by hand with a single-tooth tool; but take the cold chisel, and with a good-sized machinist's hammer apply the necessary "pressure" upon the head of the chisel, and the result will be quite astonishing, inasmuch as with two or three good licks more material may be removed than with a hundred strokes of the smooth file, although it is not converted into filings of the size of those created with the smooth file. The rough file would also create rougher filings than the smooth file, and as Mr. Schauring does not specify the size of filings, it can only be a question of material to be removed, and the same can now be answered thus: The reason a smooth file will take hold of the piece of "blued steel" is because the power applied to it is large enough to make each small tooth take hold and remove a small chip. The reason a rough file will not remove any material is, that the power applied is not large enough to make each tooth take a large chip; still less could a single-tooth tool take hold, as it takes still more power to make it take a still larger chip.

In this particular case may also come in the consideration, that the smaller the tooth, the keener its cutting edge; further, that a larger number of teeth create more friction, and as friction creates heat, the very stroke of the file heats the surface of the material and soften it, and makes it more easily cut. The latter theory can be verified by holding the hand under the falling filings; those from a smooth file will quite burn the skin, while those from a rough file will hardly be warm enough to be felt.

C. CASBERG.

Randolph, Mo.

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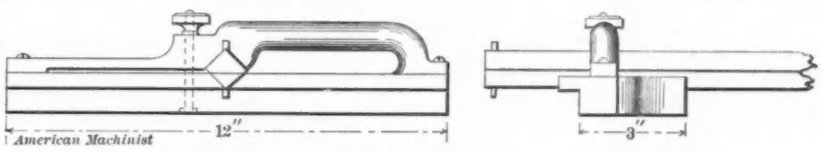
A Handy Panel Gage.

Editor American Machinist:

I send you a sketch of a panel gage which is very satisfactory to those who have used it. It is made of hard maple, and some have two interchangeable rods, one about 20 inches long and the other about 30 inches. These are ¾ inch square, and by having the rods put in the head, as shown, all lost motion from wear is taken up and all undue tightness from swelling is obviated. There is no patent on it, so far as I know. Anyway, I have none, though when I first discovered it, I intended to organize a large company and amass a fortune, but my generous nature got the better of me, and I am still poor.

A. L. BOWEN.



A HANDY PANEL GAGE.

A Plug That Enlarges by Wear.

Editor American Machinist:

In corroborating (in reverse) the article in the "American Machinist" of November 18th, "A Hole That Closes by Wear," I would say, that some years since, seeing an article in a mechanical paper from a correspondent relative to his having tried almost every kind of packing rings on piston valves, with unsatisfactory results, he filled in the grooves for packing rings, solid with genuine babbitt metal, turned them to fit size of hole in valve casing, and found them more satisfactory than anything he had tried, but that they gradually became larger by use. About that time, in repairing an engine with piston valves at our works, we fitted up the valves in that manner, and found they worked better than loose rings. The engine is yet in service. The theory of the plug getting larger, or the hole closing, is that the heat from the steam gradually expands and permanently enlarges the mass of babbitt metal forming the rings or lining of bushing, and consequently either gets larger or smaller, by use, as the case may be. Anyone having trouble with piston valves leaking steam, from wear, would be well repaid by substituting a solid babbitt metal ring on the valves.

E. FAWCETT.

Alliance, O.

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Casting a Furnace Door Lining.

Editor American Machinist:

Fig. 1, herewith, is a sketch of a furnace door lining. This casting would have been easy to mold if the pattern had been made to leave its own core. It would have given the molder no trouble to get it out; but as the walls of metal are only 5-16 inch thick the life of the pattern would have been short.

Fig. 2 shows a pattern, and Fig. 3 a core box for the same, that will stand a lot of hard usage. I found it a good plan to fasten the block *a* in the lathe, and bore out the conical part, shown by the dotted lines, before the end was rounded, which allowed the piece to "balance" while turning. Then the part overhanging all around, that serves as a core print, which was made just thick enough to complete the depth of the hole, was next nailed on, and the pattern was made.

The core box needs but little explanation. The conical block is turned to correspond to the larger size of the same in casting. When the core is placed in the mold it is just suspended and will be held in place by the cope, requiring no anchors. If a green sand core is preferred, it would be a small matter to make a "grid" to handle the same.

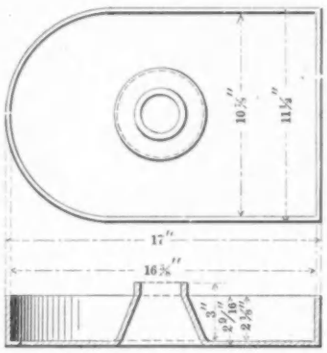

Fig. 1

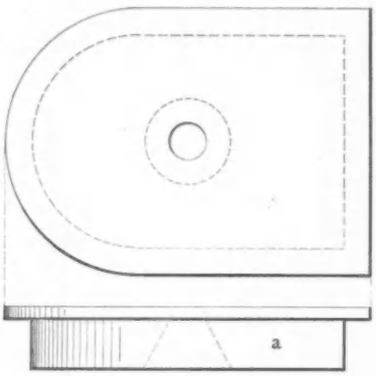

Fig. 2

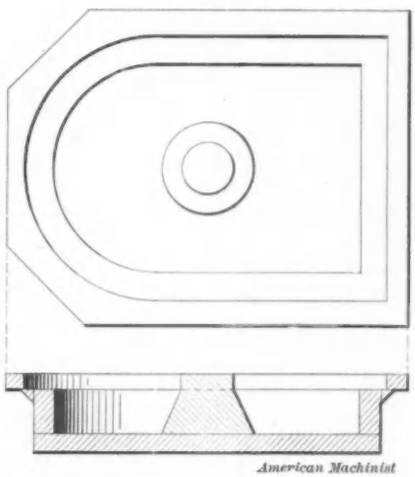

Fig. 3

FURNACE DOOR LINING PATTERN.

WM. NEWTON.

Oneonta, N. Y.

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One "long felt want" is at last supplied. A recent patent is for an illuminated keyhole. It is as yet only half complete, however. There is a push button to throw on the light. The push button may be almost as elusive as the keyhole.

Lathe and Shaper Work.

BY A. H. CLEAVES.

The following methods of doing a job calling for a good degree of accuracy were employed by the writer, and thinking they might be of interest to the general reader, he has decided to put them in print.

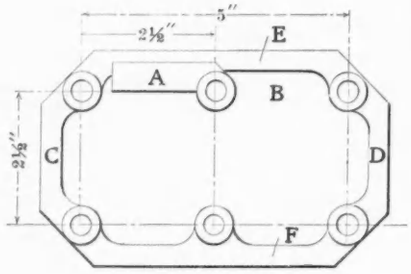

Fig. 1

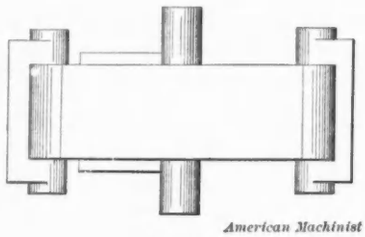

Fig. 2

THE WORK TO BE DONE.

The work was done on a pantagraph machine invented by Mr. Lathey, with the Western Bank Note Engraving Company, and while the tool itself would be of insufficient interest to the reader to call for a description, the operations shown in the cuts and explanations it is believed are worthy of illustration.

In Fig. 1, a plan, and Fig. 2, an elevation of the same parts, there are four pieces joined as shown, with a fifth piece *A* sliding upon the inside of one of the others. While this piece *A* in reality only moved in the relation shown in the cut, for the sake of showing the way of doing the work contemplated, it will be assumed that it is reversible and must coincide every way with the other pieces, whether placed as shown or reversed.

The result sought, then, is to have the six holes shown in Fig. 1 exactly parallel; *A* being adjustable one way as shown by the dotted line *B*, and the others exactly related as to distances shown by figures, 2½ and 5 inches; the four corner holes being the joints of the fixture shown.

In Fig. 3 I have shown a method that I may have illustrated in some other essay, but which will bear reshowing here, as it contains the essence of this work process. This figure shows a jig for getting three holes in line, and can be used for getting as many more as desirable by stepping along from any two holes to a third in a series, as will be explained directly.

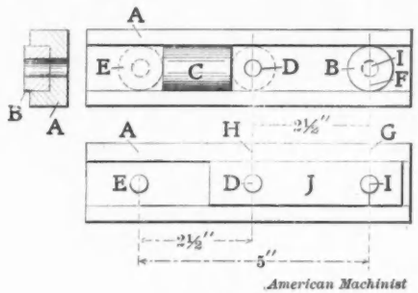

Fig. 3

JIG FOR DRILLING HOLES IN LINE AND EQUALLY SPACED.

First plane up a piece of metal *A*, as shown in three places, Fig. 3, and then fit closely to the groove in the same a ring *B* for drilling a hole centrally in *A*. If it is required to get the distance exactly 2½ inches or something else, then face off in the lathe a round piece *C* to locate *B* by in making the second hole. For instance, if *B* was ½ inch in diameter, then *C* should be 2 inches long to locate the holes exactly 2½ inches apart. Drill one hole in *A* with *B* in position shown. Place a pin or plug in this hole with *B* on it, and bring *C* against *B*. Clamp *C* to *A* and place *B* against the other end of *C* and drill the hole *D*, fastening *B* with solder or clamp firmly in *A*. Repeat the process for the hole *E*.

In the job under consideration, however, the exact distance, 2½ inches, was not so important as the same distance from each other of all the holes in the parts, so I worked as follows: I made a center line on *B*, as seen at *F*, and marked two lines *G* and *H* across *A* with a try-square. After locating *B* by these lines and drilling the two holes *I* and *D* in *A*, I transferred the same to a strip *J*, then moved it along, pinning *I* in *J* to the hole *D* in *A*, and drilled the hole *E* in *A* through the hole *D* in *J*.

This gives three holes about as near in line as the law allows, and furnishes a jig for getting the lathe face-plate fixed as follows, for doing the work properly.

In Fig. 4, *A* shows a section of a lathe face-plate having the studs for locating the work placed in the web of the casting. The holes for these studs are obtained with the piece *A*, Fig. 3, used as a jig. A center pin or stud *B*, Fig. 4, is turned true in the lathe, and the hole *D*, Fig. 3, is placed on this, and *A*, Fig. 4, is clamped to the face-plate on the line of the web; then the face-plate is removed, and the holes *I* and *E*, Fig. 3, are transferred to the face-plate, as seen at *I* and *E*, Fig. 4. Then returning the face-plate to lathe and pinning *I* and *D*, Fig. 3, to *B* and

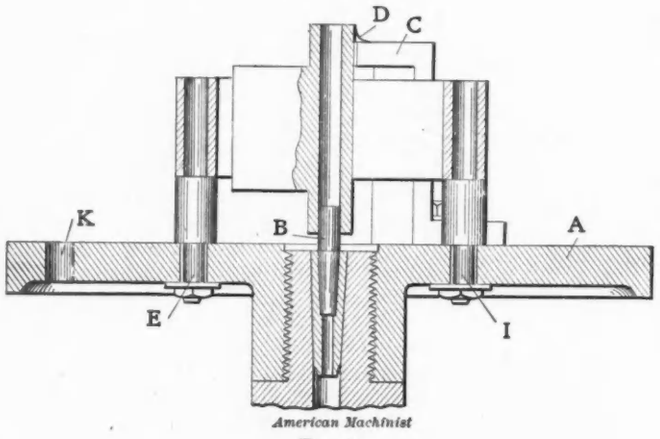

Fig. 4

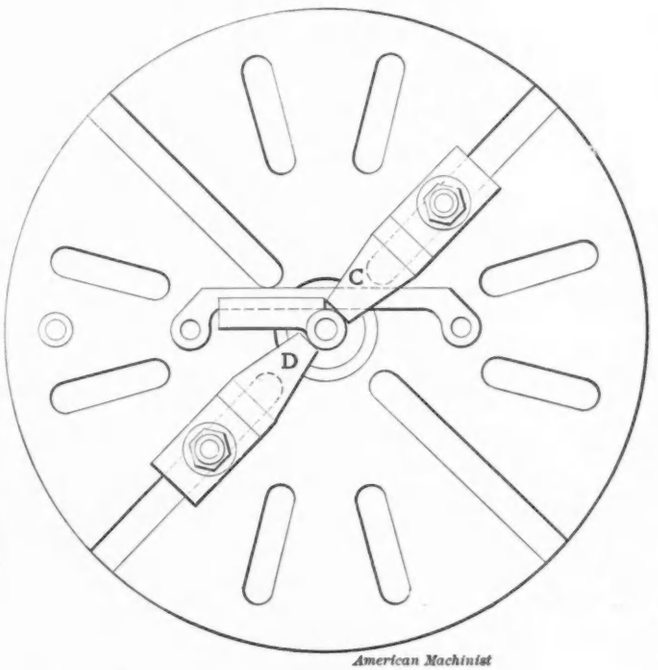

Fig. 5

THE WORK ON THE FACE-PLATE.

E, Fig. 4, respectively, the strip *A*, Fig. 3, being clamped to face-plate and the latter removed again, the hole *E*, Fig. 3, is used to locate the hole *K*, Fig. 4.

But these holes in the face-plate, it will be seen, are larger than the studs entering them; the latter have shoulders resting on the face-plate to upright them, and a counterbore is used to face off the back side of face-plate where the washers come; so the holes in the face-plate in this case would not require to be as close as if the pins were guided by the holes themselves.

This way of getting the hole *K* is the stepping-off process referred to before, and another and perhaps as good a way of making a jig or transferring holes directly to any work is illustrated in Fig. 11. The piece *A*, in this figure, is a straight-edge of any length placed directly on the work, and the rings and distance piece put in contact with it. For getting the holes in the face-plate the ring *B*, Fig. 11, can be put on the pin *B*, Fig. 4; and *A*, Fig. 11, being placed against it and clamped, other holes can be obtained with a ring placed like *C*, Fig. 11, or as described above.

For jig work where holes are to be lined, and a scale measurement will bring the holes near enough for distance apart, any piece can be used as shown in *B*, Fig. 12, and moved at convenience, while more readily clamped to work than a ring. *A*, Fig. 12, is a straight-edge, and *B* a jig for drilling holes by.

Returning to Fig. 4, the studs *I* and *E* are located with the strip *A*, Fig. 3, which is placed on the upper ends of *I* and *E*, Fig. 4; the middle hole *D*, Fig. 3, being put on the pin *B*, Fig. 4, the latter being made long enough to correspond with *I* and *E*, Fig. 4. If desirable to use the studs at *E* and *K*, Fig. 4, then *I* or *E*, Fig. 3, is placed on *B*, Fig. 4. Or one stud *E*, Fig. 4, can be located in this way for boring the two-hole pieces.

In preparing the pieces shown in Figs. 1 and 2, all the surplus metal, whether brass or iron, is removed, the holes are all roughed out, and one hole is bored and reamed out to size on an angle iron or otherwise, and this hole is used on one of the studs for obtaining the others correctly.

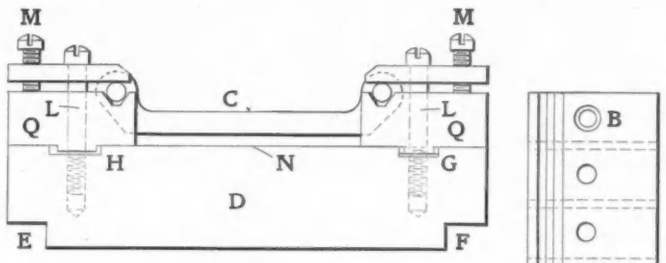

Fig. 7

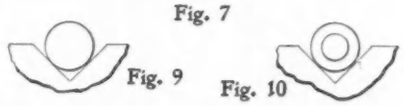

Fig. 9 Fig. 10

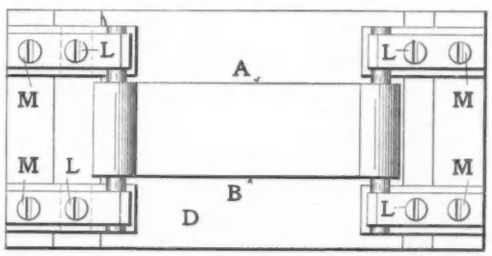

Fig. 6

SHAPING MACHINE JIG WITH WORK IN PLACE.

For example, in Fig. 1, the long piece *E* which carries the sliding-piece *A* would have the finished hole placed on the stud at *K*, Fig. 4, while the hole at opposite end was bored. The short pieces *C* and *D*, Fig. 1, would be located with stud *E* or *I*, Fig. 4, and, having obtained the end holes in *E* and *F*, Fig. 1 as shown, the long holes in the centers would be secured as seen in the cuts, Figs. 4 and 5, the center-pin *B* having been removed. The pieces *C*, Fig. 4, and *C* and *D*, Fig. 5, are brass supports, brought up against the work and secured to it with solder. This is one of the most essential parts of the job, and if cast iron is used for the work, a brass piece or pieces can be attached to the same to facilitate soldering these supports. They hold the work rigidly, which would be hardly possible with pieces shaped like these in any other way. This bracing feature must be regulated by the requirements of the work and applied at the points that need it.

The sliding-piece *A*, Fig. 1, is finished by itself, with the exception of the hole in the same in the first place, and the surface of *E*, Fig. 1, upon which it slides is obtained as follows:

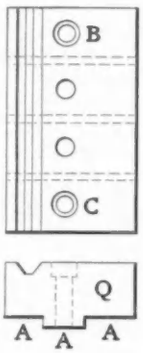

Fig. 8

The sides of this piece, *A* and *B*, Fig. 6, are faced off, while it, *E*, Fig. 1, is placed upon the studs *I* and *E*, Fig. 4; the support *C*, Fig. 4, and the slide *A*, Fig. 1, being absent. Then the surface *C*, Fig. 7, of the same piece is finished in the shaper, being held by arbors in the end holes, and resting in V-blocks illustrated in Figs. 6 and 7. As this block *D* and the V-blocks contain some interesting elements, I will explain them at some length.

Let the casting *D*, Figs. 6 and 7, be held in the shaper vise at the corners *E* and *F*, and be dressed off. Shape out the grooves *G* and *H* to receive the strip shown in Fig. 8, previously planed on the under side *A A A*, the groove *H* being made wider than the tongue on Fig. 8. Four holes are drilled in the piece shown in Fig. 8, and the two end ones *B* and *C* are countersunk if it is intended to dress off the top of casting, as the holes are used to screw the piece to *D*, Fig. 7, while the Vs are being shaped out. This piece is afterwards cut up into separate pieces *Q*, as shown by the dotted lines; the holes being for the binding screws *L*, Figs. 6 and 7. These go through the V-blocks into *D* and bind both work and block. Screws *M* adjust the clamps. Holes are drilled in *D*, Fig. 7, to correspond with *B* and *C*, Fig. 8, and the piece in Fig. 8 is finished in this position, the surface *N* of *D*, Fig. 7, being dressed off the last thing before the piece in Fig. 8 is screwed down to it. This operation of dressing off the surface *N* of *D*, Fig. 7, is the gist of the whole thing, and must be done every time *D* is replaced in the shaper, or if the shaper-vise is turned quarter around.

The work is clamped first at *G*, Fig. 7, and then at *H*, the latter groove being wider than the tongues on *Q*, permits the latter to adjust themselves to the arbor at that end of the work.

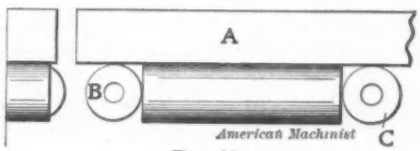

Fig. 11

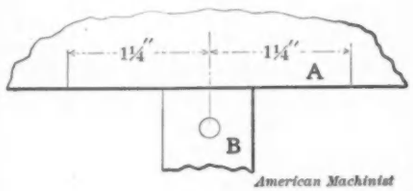

Fig. 12

ADDITIONAL METHODS OF DRILLING HOLES IN LINE.

Figs. 9 and 10 show how this kind of work with one or two arbors, straight or parallel holes, would be arranged when the holes were of different sizes. The arbor in small hole would carry a collar to fit the V; the diameter being the same as arbor in large hole.

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The Year Closes and the Year Begins.

With this number the 20th volume of the "American Machinist" closes, and by the time it reaches our readers, the first number of the new year will be ready for the presses.

The presses will be new ones, by which we expect to get still better results than have been possible during the past year; notwithstanding the fact that this past year's work has been considered excellent. The entire paper will be printed from new type, advertisements included, and 15,000 copies will be printed each week in the expectation that this will enable us to supply all demands for back numbers during the year; something which we have been unable to do during the past year.

The results of the year's work are very gratifying to us. Never before in the history of the paper has there been so much evidence of appreciation on the part of readers, and never has there been a period when so much interest and such hearty responses have been called out by our efforts to provide matter of interest to those who, in one way or another, are interested in the production, sale and use of machinery. We are happy to be able to say that the paper is decidedly stronger than ever before, and better prepared for future work.

We contemplate no radical or decided change during the year to come, but shall endeavor to make each number as valuable as possible to all who have to do with machinery. We have now on hand very much material which, when presented, will, we feel confident, be appreciated by our readers, and among this a great deal of matter pertaining to foreign engineering establishments, which will be liberally illustrated by photographs and drawings gathered by Mr. Miller during his tour of European machinery-building establishments. Many of the most famous and most interesting workshops of Europe will be thus illustrated and described.

We hope every one of our readers found a well-filled stocking awaiting him on Christmas morning, and that the New Year will be a happy and a prosperous one for all of them.

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The Touch of the Customer.

While the world continues to move, the concern that is stationary must inevitably be left behind. It is absolutely and universally impossible for any manufacturing establishment to remain prosperous without being progressive. No matter how perfect and satisfactory may be the product of to-day, no matter how boundless may be the market for it, or how easy it may be to dispose of the entire output, these conditions cannot abide without continual improvement.

Some builders of machinery may be apt to forget or to ignore this, but there is no class who could do so with less risk of ultimate extinction. The fashion of machinery passes rapidly away. Styles become old and then obsolete before we know it. In many lines of machinery and of machinists' supplies, the makers are not the users; and yet if those makers do not keep constantly and freshly informed of the conditions under which their goods are employed, of the success which attends their use, and especially of the directions in which still greater successes may lie, and if hints in these directions are not persistently followed up, nothing but disaster can ultimately await them.

The makers of emery wheels, for instance, cannot, in the nature of things, be extensive users of emery wheels, and yet they should know better than anyone else all about the proper and most satisfactory ways to use them. The builders of machine tools, of lathes, planers, shapers, millers and the like, it may be argued, are not in the same position as the emery-wheel makers, as they certainly are able to use their own tools. The trouble is that they are able to try them, and they do try them, under almost ideal conditions both as to work and workmen, while the real things most necessary to be known are the weak spots that develop under conditions which are not what could be desired, but which inevitably are encountered when the tool goes out from under the parent roof.

This knowledge, so necessary to the well-being of the tool builder and the efficiency of his tools, will not come uninvited, but must be diligently sought for wherever it may be found. Obviously, the best way to get the information is directly from the customer. It makes a great difference, therefore, as to the means of communication that may be employed between the manufacturer and the customer. The maker of the article usually initiates and has exclusive control of the means of communication. Whatever a man makes and wants to sell will not usually be sold until he at least lets the customer know, in some way, that he has it for sale. The so-called demand for things is mostly pure fiction. Not one-tenth as many daily papers would be sold if the public and the newsboys were to exchange places, and if their attitudes toward each other were reversed. The only everlasting demand is the demand of the manufacturer for consumers.

To the manufacturer it makes all the difference in the world what means he may employ for the selling of his goods, not merely for the accomplishment of each present sale, but for the securing of the customer of the future. The glib-tongued braggart of the auctioneer type may be thought, perhaps, the best to effect the immediate sale; but he may be the very worst for the healthy growth of the business. Such a one can, at the best, perform but one of the three functions of the true machinery salesman, all of which must be kept in constant exercise to promote the best interests of all concerned. The first duty is, of course, to sell, and this can best be done by knowing as clearly as possible what is wanted to be done, and then by telling the straight truth about the means that can be furnished for the doing of it. After the sale, it is necessary to follow up the machine where possible (and it usually is possible), to see that it has fair usage and a fair chance to do its best. Beyond this, it is most necessary to keep constant watch of the weaknesses and deficiencies of the machine, so that in future output they may be corrected, and to see what opportunities are suggested for doing more and better work by changes that may be made in the machine. From these things improvements grow. It is evident that these duties can never be all properly fulfilled except by a good mechanic, one who is intimately in touch at both ends and a

perfect conductor all the way through. Some of the best salesmen ever known to the trade have been the mechanical heads of the establishments which they have represented. These have been the live and progressive concerns, also. Nc man is too good a mechanic to be a seller of machinery. Probably the nearest approach, within our knowledge, to the ideal machinery salesman to-day is a man who is the inventor and designer of the machine which he sells. He knows the machine, (one of the valuable machine tools of the day) from the drawing room up, has individually sold most of the machines that are in use (and the number is large), and has followed them up to see that they have done their duty. It is not necessary to say that the machine is still being improved, and that the firm which builds it is growing stronger daily. Every tool-building firm especially needs to feel the intimate touch of the customer.

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Central Station Engineering.

A correspondent at Springfield, O., sends us an account of the mutations through which a street railway plant in his State was put, in the efforts of the engineers (?) to improve it.

The first improvement was the installation of a fan and system of distributing pipes to blow cold air on the bearings and blow the friction of the bearings away by dissipating the heat after its generation. Following this the station of four generators was rearranged and driven by a single engine, although the day load was not three-eighths of the running load. All this was done as an improvement on a plant which was correctly arranged at the start, with well-designed dynamos and separate engines which were operated as required under nearly full load.

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We regret that we were not permitted to enjoy the fifth annual oyster roast of the Berlin Iron Bridge Company, which occurred on the 15th inst., and to which we were kindly invited. The first of these roasts occurred in fulfilment of a promise made by President Charles M. Jarvis, to provide such an entertainment if the men got out 1,200 tons of work for the current month, the previous record being 1,000 tons. These roasts are now an established institution, and are growing to be of almost national importance. At this latest affair, including the 400 men and their wives and sweethearts, the attendance was about 1,800, including prominent men from all the New England States, New York, New Jersey and elsewhere. The oysters were served in fine style upon long tables in the forging department, and dancing occurred in the template room. The templates handled here, it should be remembered, are not for sewing machines, but for bridges. The works, covering now 28 acres, were brilliantly illuminated, and thoroughly inspected by the visitors, who were received by the president and the other officials of the company. Such enjoyable affairs are to be most warmly commended. They cannot fail to promote good feeling all around.

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The National Association of Manufacturers sends us information regarding the establishment of the exhibition warehouse at Caracas, Venezuela, and a long list of American manufacturers who will have exhibits there, among them a number of builders of machinery. From this and other evidence it seems that this movement for the establishment of such a warehouse is meeting with encouragement, and that it will probably be successful.

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Personal.

Chief Engineer W. B. Bayley has been detached from the Civil Service Commission and ordered to the Massachusetts.

Passed Assistant Engineer W. B. Day, U. S. N., has been detached from the Adams and granted sick leave for six months.

Chief Engineer A. V. Yane has been detached from the Washington Navy Yard and ordered to duty in connection with the Civil Service Commission.

Mr. George M. Chandler, late of the Chandler & Taylor Company, of Indianapolis, Ind., has connected himself with The Brownell & Co., Dayton, O., in the capacity of salesman.

Mr. Charles Davis, of the Davis & Egan Machine Tool Co., of Cincinnati, O., returned from Europe on the 21st inst. and reports having transacted a very satisfactory amount of business there.

We will consider it as a favor if our readers will send in items of news regarding changes of foremen, superintendents or others prominently connected with the machine business. Such items are legitimate news of the trade, and we are glad to make room for them.

Mr. A. Roeper, who is connected with the firm of de Fries & Co., of Dusseldorf, arrived in this country on the 21st inst. and will remain about two months, visiting our machinery building establishments and making such arrangements as may seem advantageous for the sale of American machine tools in Germany.

Mr. Robert Laidlaw, of the Laidlaw-Dunn-Gordon Co., Cincinnati, recently returned from a trip to Great Britain and reports a very satisfactory business there so far as his company is concerned. He expresses the opinion that foreign markets for American machinery are improving and are likely to continue to do so.

Mr. O. S. Walker, who for some years past has been connected with the Norton Emery Wheel Co., of Worcester, Mass., as designer of machinery, has severed his connection with that company, and will handle the sales of the Worcester drill grinders made by the Worcester Polytechnic Institute, this institute having undertaken the manufacture of Mr. Walker's new drill grinder which was illustrated in our issue of October 28th, as well as the original grinder, which was also designed by Mr. Walker. In addition to this Mr. Walker will devote some attention to designing special grinding machinery.

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Inquiries for Machinery.

Those who make, or who may know of the makers of such machinery as is called for below, will oblige us by sending name and address, mentioning the number of the inquiry. We cannot forward catalogs. We have inquiries as follows:

18. From England, for machinery for blocking, molding and wrapping soap.

19. From Russia, for match-making machinery.

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Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(182) G. C. T., Warsaw, Ind., writes: I have the following train of shafting and gearing, and would like to have some idea of the relative strength of the different parts; that is, where is the weakest spot? A pulley 24 ins. diameter, with 8-in. double belt on a steel shaft $1\frac{1}{16}$ inches diameter, 288 revolutions per minute; on this shaft a pinion with 16 teeth, 4-inch pitch diameter, 2½-inch face. This pinion works into a 64-tooth gear, part of a compound gear on a stud. The pinion of the compound is 17 teeth, 1-inch pitch, 3-inch face. This works into a 102-tooth gear on a cast-iron shaft 3½ inches diameter. As the belt runs in a place where it is very dry and dusty, it will not begin to transmit the theoretical power that you would figure out for it. A.—With a double belt running under favorable conditions, 40 square feet of belt surface per minute will transmit one horse-power. If in this case we allow 100 square feet, the power which the belt will transmit will be $2 \times 3.14 \times 288 \times \frac{3}{3} \div 100 = 12$ horse-power. For the power that the steel shaft will transmit, a convenient formula is: H. P. $= .032\, r\, d^3$, r being the number of revolutions, and d the diameter in inches. Then $.032 \times 288 \times 1\frac{1}{16}{}^3 = 67$ horse power of shaft. For the driving power of gear teeth we have the following formula:

$$H\,P = \frac{p \times f \times d \times r}{850}$$

p being the circumferential pitch, f the face of tooth, d the pitch diameter in inches, and r the revolutions per minute. The first pinion having 16 teeth and 4-inch pitch diameter, the diametral pitch will be ¼ inch, and the circular pitch ¼ × 3.14 = .7854 inch. Then

$$\frac{.7854 \times 2.5 \times 4 \times 288}{850} = 2.66 \text{ horse-power}$$

of first pair of gears. For the second pair of gears, taking the last gear, which from the data given will make 12 revolutions per minute, and whose pitch diameter, the

circular pitch being 1 inch, will be $102 \div 3.14 = 32.48$ inches, we have

$$\frac{1 \times 3 \times 32.48 \times 12}{850} = 1.37 \text{ horse-power.}$$

For cast-iron shafts we have the formula: H. P. $= .012\, r\, d^3$. The last shaft being 3½ inches diameter and 12 revolutions per minute, we then have $.012 \times 12 \times 3\frac{1}{2}^3 = 6.17$ horse-power. The weakest spot seems to be in the gearing. The belt power and the strength of the first shaft are excessive, but the remainder of the train is as nearly consistent as rough millwright work usually comes.

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Our English friends say various things concerning us. We can balance one remark against another and obtain an interesting average. One of the latest is the following: "In these days one notices a tendency to believe that American practice is independent of principles; it would be more correct to say that it is devoid of them. The fact that a certain machine or system works, and works well, is no proof that it is perfect or economical. Many of our early bridges are as safe as houses, but we build better ones now for half the money. No steam engines have ever worked more satisfactorily than those made by Boulton and Watt, but we cannot afford them nowadays. The system of construction by trial and error is all right in America, but in England an engineer is paid to use his brains, and not to get his experience at the expense of his clients."—John S. Raworth, in "The Electrician," London.

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Labor-saving machinery is naturally a blessing, not a curse; and it is the maladjustments of human laws, not the decrees of infinite wisdom and justice, that make it seem like a curse instead of a blessing.—"Cleveland Recorder."

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It is announced that the E. P. Allis Co., of Milwaukee, Wis., have donated to Columbia College a complete steam laboratory which will include a triple expansion Corliss engine and an air compressor.

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The latest invention in the nickel-in-the-slot line is for selling air. You connect your cycle wheel tire to the apparatus, drop in the coin, and it is instantly inflated to the desired pressure.

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If J. O. S. will repeat his inquiry and give his full name and address we will answer by mail.

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Technical Books.

THE ELEMENTARY PRINCIPLES OF MACHINE DESIGN. By J. G. A. Meyer. Ninety 5 x 7¼-inch pages, with 41 illustrations; paper covers. The Industrial Publishing Company. Price 25 cents.

This book, No. 1 of the Industrial Library, is a thoroughly high-class work at a remarkably low price. The engravings and printing are excellent, and the matter is in Mr. Meyer's well-known simple and painstaking style—in fact, there is nothing cheap about the book, except its price.

Simple rules for proportioning many parts of machines are given, and actual cases are worked out in full. The man who cannot read this book with profit is hopeless. The publishers will not find it easy to maintain the standard here set for their new series.

STEAM BOILERS CONSTRUCTED BY YATES & THOM, BLACKBURN, ENGLAND 171 7x10 in. pages, with 155 illustrations Price, 5 shillings.

This is one of those manufacturers' catalogs which we sometimes receive, and which are worthy of a more extended notice than we can give them in our regular catalog column. The book is well illustrated and printed on plate paper, and contains a large amount of useful information. This pertains, of course, to English practice in boiler construction, and no clearer idea of the great differences existing between English and American boiler practice could be formed than this book affords, and we may remark in passing, that no one can examine the book without being impressed with the very substantial character of English boiler work. Besides covering boilers of many types, it also includes economisers, feed pumps, injectors and a large variety of boiler fittings—all, of course, of the English type. The book is an example of the best practice in catalog making, and would form a useful addition to the library of anyone desiring to post himself on English boiler practice.

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Commercial Review.

NEW YORK, Saturday Evening, Dec. 25

MACHINE TOOLS AND OTHER MACHINERY.

The holiday season is now upon us, when nobody expects to do any business, to speak of, in the machinery lines; but that does not dim the thought of what has been done and what will be done in the near future. We expect to present, next week, some letters from various prominent tool-builders throughout the country, which, together, will define the business situation in that line with great accuracy. This week, however, we have made the customary round of investigation among companies in the local market, and may say a few words in regard to the machine-tool business as it here appears. It is natural that during the last day or two the closing up of work for a day's resting spell should be absorbing more attention than anything else, but time has been found to make a few statements to us in regard to business conditions.

The best report probably is, that there is an encouraging amount of inquiry, predicting a healthy business in the new year. During the last month or so trade has been marked by no sensational features, yet sales have averaged a fairly good volume, it seems, and we think it may safely be said that business is gradually gaining strength.

Remarks a member of a leading New York machine-tool firm: "Business is to a great extent the same as ever, but, I think, gradually getting better. The railroads have not yet placed many heavy orders for tools, but they have begun to talk, and that indicates that eventually they will buy. Prices on heavy as well as light tools seem to have a healthy tendency."

"If our trade improves next year as it has done of late," says a dealer in a variety of machinery, "we shall be perfectly satisfied. The result of the past two or three months has surprised us. Our export sales are good, although we have not been sending a great many machine tools abroad of late."

"Business seems to be improving," says the head of another house. "We are doing considerable in exports. For instance, we shipped, this week, three consignments to England. We are also about shipping some boilers to a plantation in Cuba. We have been selling some metal-stamping presses in the English market, and have now on hand an inquiry for machine tools of another nature for a factory there. We are selling tools also to Japan, and are hoping to secure a contract which is to be let by a railroad in Germany, for four machines aggregating nearly a hundred tons."

About as large a tool of its kind as is very often seen is a 54-inch slotter, of Bement, Miles & Co.'s make, which has been installed in the shops of the General Electric Company, at Schenectady, N. Y.

The Brown & Sharpe Manufacturing Company has increased the discount upon most of its milling cutters from 15 per cent., as formerly, to 25 per cent.

The Geometric Drill Company, Westville, Conn., makers of special machinery and tools, write us: "We are very busy at present on regular work, nearly 75 per cent. of which is foreign orders."

A certain large concern in an Eastern State is reported as having good sales of small tools, such, for instance, as measuring instruments.

The statement is made that the shipments to England to be made by the General Electric Company and the Sprague Elevator Company, of material for the London Underground Railway, are so large that a special vessel will probably be chartered to convey it across the Atlantic.

In a letter received by us from the Otto Gas Engine Works, Philadelphia, is contained the laconic remark: "Business is good." We may supplement this by saying that there is now a profitable and increasing export business in gas engines, and that a field for them is opening in the Spanish-American countries.

An engineering feat, which, it is said, will be one of the greatest of its kind ever attempted, is the contemplated construc-

tion of a railroad bridge in Japan over the Straits of Shimonoseki, from the city of that name to Hiogo. It will be a mile or more in length, and high enough to allow ocean steamers to pass under it. It is believed that the greater part of the iron work must be obtained abroad.

In an advance sheet of the United States Consular Reports is published a letter from Joseph Rawicz, Consul at Warsaw, in which he mentions two things which handicap the sale of American manufactures in Russia: (1) The circulation of goods of inferior quality made in Europe, especially in Germany, branded "American"; (2) the long credits allowed by British, French, German and other manufacturers, who investigate carefully to see where this may safely be done. It is thought by the consul that both of these difficulties may, in a measure, be overcome by the contemplated establishment by the Exporters' Association of America, of a sample room for American manufactures in Warsaw, with an agency for their introduction and sale throughout Russia.

The Frick Company, of Waynesboro, Pa., are busy, particularly on refrigerating and ice machines, rather than on engines, though for these, also, business is pretty good and the outlook encouraging. Orders are now on hand for twenty-five ice and refrigerating machines of from 2 to 200 tons capacity per 24 hours each. On this class of work, not only the factory but the drafting room is kept busy until a late hour of the evening. There is also a good demand upon them for agricultural machinery. Their sales of ice-making machinery are increasing relatively faster than those of refrigerating machinery. The respective ratio used to be 20 against 80 per cent. Now it is 40 against 60 per cent. Their New York office is largely occupied with export trade in these two lines, which is found extremely encouraging. Among recent inquiry the Japanese field is particularly mentioned.

MACHINERY EXPORTS FOR OCTOBER.

According to the "Monthly Summary of Finance and Commerce," published for October by the Bureau of Statistics of the United States Treasury Department, exports of metal-working machinery for the month of October amounted to $337,792, and for the four months ending with October, $1,228,516. The figures for September, 1897, had previously been reported, $308,838. Electrical machinery exports were $116,794 for October; $489,913 for the four months; $129,567 for September. Pumps and pumping machinery, $135,804 for October; $638,840 for the four months; $152,117 for September. Shoe machinery, $103,283 for October; $267,602 for the four months; $57,433 for September.

Exports of other lines of machinery, which, having been separately classified for a longer time, permit of a more extended comparison, included: Locomotive engines, $427,649 for October this year; $53,555 for October last year; $88,364 for September this year; $2,747,077 for the first ten months of this year; $2,635,318 for the first ten months of last year. The figures upon stationary engines were: For October, 1897, $24,895; October, 1896, $42,955; September, 1897, $34,229; first ten months, 1897, $311,517; do., 1896, $202,669. Upon boilers and parts of engines they were: For October, 1897, $73,964; October, 1896, $34,738; September, 1897, $39,220; first ten months, 1897, $527,916; do., 1896, $524,813. Upon printing presses and parts thereof they were: For

(Continued on page 36.)

Business Specials.

Gear wheels, gear cutting. Grant; see page 16.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Ct.

Brass ptrn. letters and figs., for sweatg. on metal trns. Knight & Son, Seneca Falls, N. Y., Box 12.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday Morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

Experienced mech. draftsman. Box 137, Am. Mach.

Mechanical superintendent will be at liberty Jan. 1, owing to consolidation of business; 8 years in last place. Box 139, American Machinist.

Wanted—Position by superintendent who understands his business, who wants to change the first of the year. Address Box 117, care Amer. Mach.

Practical, up-to-date die, tool and jig maker wishes change; expert on sewing mch., typewriter, clock, bicycle and novelty tools; draftsman; capbl. of taking charge; A1 refs. Ad. "Yank," Am. Mach.

Superintendent, Eastman Kodak, desires change—quantity-quality system—20 years experience on bicycles, cameras, tools; references; no experiment; good manager; ready Jan. 15. Box 141, Am. Mach.

Help Wanted.

Wanted—Machinists in every shop to introduce my new round pocket level "Which Way;" most liberal inducements. E. G. Smith, Columbia, Pa.

Wanted—Mechanical engineer, familiar with the designing of hydraulic machinery, such as presses, riveters, etc. Address Box 142, American Mach.

Wanted—First-class draw die and forming tool maker for electrical socket and cutout work; apply stating wages and experience, to Canadian General Electric Co., Limited, Peterboro, Ont.

Foreman boiler maker for shop mfg marine and stationary boilers and tank work. Must be first class and capable of handling men to best advantage. Address, stating experience, to Box 108, Am. Mach.

Chief engineer wanted for large steam plant, comprising about 5,000 H. P., principally Corliss compound engines; must have some knowledge of dynamos, and be thoroughly capable of taking indicator diagrams, setting his own valves and taking entire charge of power plant; location in a healthy country, three hours from New York; to the right man, who must be a conscientious worker, and of strictly sober habits, a pleasant permt. pos. with a growing concern is assured. Ad., stat. exp. refs. and saly. expected, "Corliss," Amer. Mach.

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Job lot radiators, 12½ c. ft. S. M. York, Clev'nd, O.

Dies & Die Mak'g, $1. J. L. Lucas, Providence, R. I.

I make dies; send sample and see what they cost. J. L. Lucas, Providence, R. I.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Best and cheapest Bolt Header, made by Bausch & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O.

Wanted—A small machine shop in New York City. Address Box 118, care American Machinist.

We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middletown Machine Co., Middletown, Ohio.

Wanted—Makers of automatic machines for the production of studs and rollers for bicycle chain. Address Box 143, American Machinist.

Lathes, planers, drills, milling machines, vises, also brass working machinery second-hand; must be modern and in first-class condition. C. C. Wormer Machinery Co., Detroit, Mich.

We wish to buy a machine for economically boring a 4⅛" diameter hole 2 feet deep into a 5" diameter solid steel bar 30" long; we shall be glad to hear from any one manufacturing or having such a machine for sale. P. M. Sharples, West Chester, Pa.

THE CROSS OIL FILTER

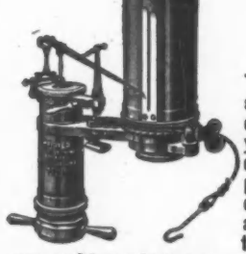
actually reduces oil bills 50% or more. Sent on approval. Used in 14 countries. Testimonials from leading firms in every field of industry.

Business established seven years.

THE BURT MFG. CO.
AKRON, O., U. S. A.
Largest Manufacturers of Oil Filters in the World.

DO MACHINE SHOPS

give the same attention to their MOTIVE department as other plants? We think not.



The IMPROVED ROBERTSON --- INDICATOR --- settles beyond a doubt whether your ENGINE IS developing full power for fuel consumed and enables you to determine the horse-power of leased power.

WE MAKE OTHER GOODS
SUCH AS
EXHAUST HEADS—PLANIMETERS—STEAM SEPARATORS—OIL FILTERS—HEATERS—OIL EXTRACTORS—SHAKING GRATES—3-WAY VALVES—ELBOW COCKS—EUREKA PACKING.

Our Catalogue describes all of these. Don't YOU want one?

JAS. L. ROBERTSON & SONS,
New York. Boston.

Machine Engineer

at present working in the Machine Works of L. A. Riedinger in Augsburg (Bavaria brewery machinery dept.), practically and technically instructed, 25 years of age, applies for durable situation in a large American factory. Offers marked A. B. 14 to be addressed to

The Annoncen-Exped v. G. L. DAUBE & CO.,
Augsburg, Germany.

(Continued from page 35.)

October, 1897, $105,460; October, 1896, $12,664; September, 1897, $38,131; first ten months, 1897, $575,874; do., 1896, $298,291.

Quotations.

NEW YORK, Monday, December 27.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 75 @ $12 00
No. 2 foundry, Northern	11 25 @ 11 50
No. 2 plain, Northern	10 75 @ 11 00
Gray forge, Northern	10 25 @ 10 50
No. 1 foundry, Southern	10 75 @ 11 00
No. 2 foundry, Southern	10 25 @ 10 50
No. 3 foundry, Southern	10 00 @ 10 25
No. 1 soft, Southern	10 75 @ 11 00
No. 2 soft, Southern	10 50 @ 10 75
Foundry forge, Southern	9 75 @ 10 00

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.05 @ 1.10c.; refined, 1.10 @ 1.20c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.30 @ 1.50c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some grades perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel — Ordinary brands, from store, in small lots, 1.50c.

Cold Rolled Steel Shafting—Base sizes, from store, in small lots, 2.30 @ 2.40c.

Copper—Carload lots, Lake Superior ingot, 11c.; electrolytic, 10¾ @ 10⅞c.; casting copper, 10½ @ 10¾c.

Pig Lead—Carload lots, 3.70 @ 3.75c., f. o. b., New York.

Pig Tin—For 5 and 10-ton lots, 13.70 @ 13.80c., f. o. b.

Spelter — Carload lots, 3.85 @ 3.95c., New York delivery.

Antimony—From 7¼ @ 8¼c., according to brand and quantity.

Lard Oil—Prime city, present make, commercial quality, in wholesale lots, 38 @ 41c.

▲ ▲ ▲

Manufactures.

At Norway, Me., Will Austin is putting up a new machine shop.

At Allentown, Pa., the Heilman Boiler Works will build an addition.

The Enterprise Enameling Company, of Bellaire, O., is to erect a new factory.

Owing to an increase of trade, the Lebanon (Pa.) Chain Works will be enlarged.

The Donaldson Iron Company, at Emaus, Pa., is to make additions to its plant.

The Benson Knitting Company, of Rockford, Ill., is to place new machinery.

The E. B. Eddy Company, of Ottawa, Canada, expects to enlarge its plant next spring.

The Boston Electric Light Company has decided to erect a plant in South Boston, Mass.

The Atlantic Refining Company, of Philadelphia, Pa., is about to erect a new pump house.

At Philadelphia, Pa., Architects Dull and Peterson have plans for a three-story factory, 71 x 35 feet.

The Cambridge (O.) Manufacturing Company (S. W. Nicholson, manager) contemplates building an addition.

The Pen Argyl machine shops, at Pen Argyl, Pa., were recently destroyed by fire. The loss is estimated at $25,000.

The Ford Morocco Company, Wilmington, Del., has decided to put in a new engine in the new electric-light plant.

The Diamond Rubber Company, of Akron, O., has reorganized and increased its stock. New buildings are to be erected.

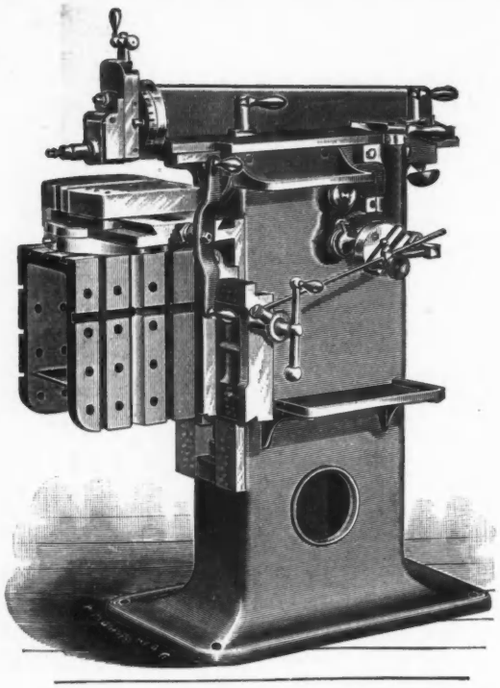
The Dillon Machine Company, of Lawrence, Mass., has been incorporated. I. P. Dillon is president and H. C. King treasurer.

Mr. James N. Gamble, of Cincinnati, O., has secured a permit for the erection of a factory building on Central avenue, that city.

The United States Iron & Tin-Plate Manufacturing Company, of Demmler, Pa., have made an addition to their plant recently.

At Pittsburg, Pa., the J. L. Robinson Company has leased a building, in which they will engage in the manufacture of metal polish.

(Continued on page 37.)



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15-inch Hendey Shaper.

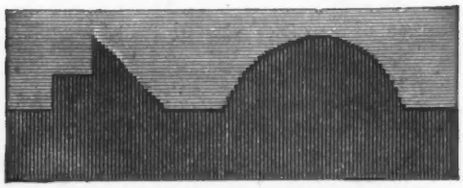
Latest Improvements.
Useful Attachments.
Strong and Powerful.

...FOR...

Die Work, Tool Room or General Shop Work.

▲▲▲▲

The stroke can be adjusted for curves with machine in motion. The stroke can be adjusted for angles with machine in motion. The stroke can be adjusted for irregular work with machine in motion. It has adjustable table for planing taper work; table can be removed for fastening work to apron. Has a strong graduated swivel vise. Quick work, rapid changes, modern ideas.



This cut shows how stroke can be adjusted with machine in motion by micrometer; adjustment fine and delicate. SEND FOR CIRCULAR.

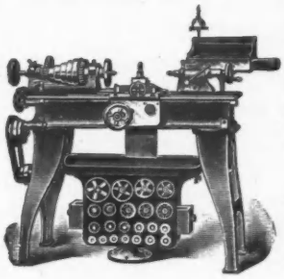
▲▲▲▲

THE HENDEY MACHINE CO.

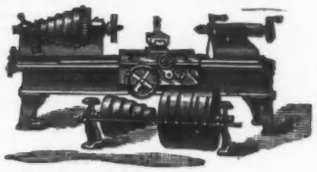
TORRINGTON, CONN.

Agents for the Pacific Coast—PACIFIC TOOL AND SUPPLY COMPANY, San Francisco, Cal.
J. W. CREGAR, Philadelphia, Pa. **BOURSE EXHIBITION, Philadelphia, Pa.**

European Agents, SCHUCHARDT & SCHUTTE, Berlin, Vienna, Brussels, Stockholm.
CHAS. CHURCHILL & CO., Ltd., London, and Birmingham, Eng.
ADPHE. JANSSENS, Paris, France.
EUGEN SOLLER, Basel, Switzerland.



ENGINE Lathes for Tool Room and Manufacturing Uses. Gap, Grinding, Monitor and Spinning Lathes, Turret Head Machines.



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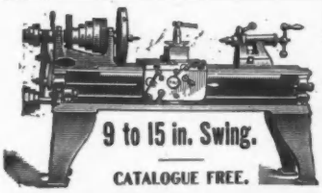
THE PRATT & WHITNEY CO., Hartford, Conn., U. S. A.

NEW YORK: 123 Liberty Street. BOSTON: 144 Pearl Street.
CHICAGO: 42 South Clinton Street.
LONDON, ENG.: BUCK & HICKMAN, Whitechapel Road.
PARIS, FRANCE: FENWICK FRERES & CO., 21 Rue Martel.



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ARE YOU LOOKING for a lathe? We are building them in various sizes from 9 in. to 15 in. swing, in various lengths, both engine and speed lathes. Our designs are the **latest**, while the **workmanship, material** and **finish** are of the **highest** order. Our catalogue will tell you all about them, as well as of our planers, shapers and other tools.

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117 & 119 Culvert St., Cincinnati, Ohio, U. S. A.

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★★★
Foot Power Screw Cutting, Automatic Cross Feed, 9 and 11" Swing.
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EVANS FRICTION CONE PULLEYS
Hanging and Standing CONES.
MADE IN ALL SIZES.
Thousands in use transmitting from 1 to 40 H. P.
For information address, G. F. Evans, Proprietor,
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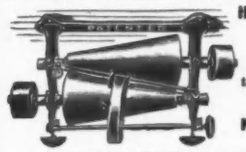
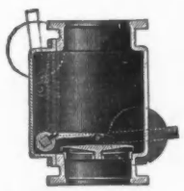


C. W. BURTON, GRIFFITHS & CO., Agents, London, Eng.



Excelsior Straight-Way Back Pressure Valve.

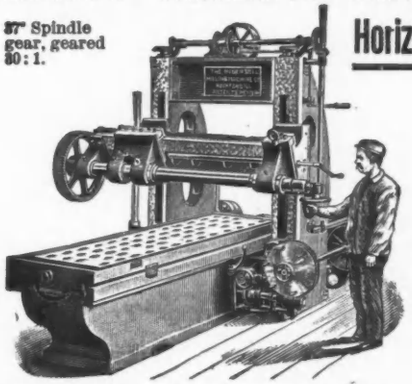
This valve has no dash pots, springs, guides or complicated levers to get out of order. It is simple, reliable and well made. Never sticks, and can be relied upon at all times when using exhaust steam for heating; or when used as a relief, or free exhaust on a condensing plant, it has no equal. It is noiseless and free from any complicated attachments

JENKINS BROTHERS, New York, Boston, Philadelphia, Chicago.

HEAVY MILLING MACHINES EXCLUSIVELY

Horizontal or Vertical Spindles or Both

37" Spindle gear, geared 30:1.



SIZES:
15", 20", 24", 36", 48", 60", any length.

Wide range of cutter speeds.
Variable table feed from 3-16" to 10" per minute.
Power elevating and lowering device.
Table adjusted by power in either direction.

Write for full information and prices, to

The Ingersoll Milling Machine Co.
P.O. Box 2777,
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Foreign Agents: C. W. Burton, Griffiths & Co., London, Eng. A. Janssens, Paris, France. DeFries & Co., Berlin and Dusseldorf.

Eastern Branch, 126 Liberty St., New York.
Cable address, "Ingersoll," Rockford.

60" x 36" x 8' Mach. Net Shp'ng Wgt. 24,000 lbs.

(*Continued from page 36.*)

At Scottdale, Pa., a new steel mill is to be constructed. Messrs. Wilkins and Davidson have been engaged to superintend the work.

B. F. Perkins & Sons, Holyoke, Mass., are to commence the manufacture of calendar rolls, and a shop for that purpose is to be erected.

The American Stoker Company, of Brooklyn, N. Y., has been incorporated. The directors are R. C. Peabody, David H. Valentine, A. J. Pouch, etc.

The Motive Power Company, of Bowdle, S. D., has been incorporated. The incorporators are John F. McGlenn, William Edwards, Henry C. Mass, etc.

The Movable Fire Escape Company, of Minneapolis, Minn., has been incorporated. The incorporators are Henry Steinmann, Fred Fagien and G. A. Will.

Benjamin Walker is going to build a one-story brick dyehouse, 36 x 64 feet, for J. P. Mathieu & Co., at Ninth and Westmoreland streets, Philadelphia, Pa.

At Port Byron, N. Y., the Port Byron Car Truck Company has been formed. Among the Board of Directors are Henry Fenn, Benjamin Lathrop, S. F. Dixon, etc.

The H. Wales Lines Company, of Meriden, Conn., has signed a contract with A. & S. Blumenthal, of New York, for the erection of a silk velvet mill at Shelton, Conn.

The Otto Gas Engine Works, Philadelphia, Pa., have just installed two 120 horse-power gas engines at Listerville, W. Va., and two 50 horse-power engines at Mannington, W. Va.

The Cincinnati, Hamilton & Dayton Railroad Company is building new shops at Lima, O., and the contract for woodworking machinery has been awarded to J. A. Fay & Co., of Cincinnati, O.

Hart Bros.' Machine Company, Clarksburg, W. Va., have just closed a contract with the Northern Pacific & Alaska Mining, Transportation Company, of Snug Harbor, Alaska, for two sawmill outfits.

The City Foundry Company, of Cleveland, O., has been incorporated for the purpose of engaging in and conducting a general foundry business. The incorporators are James J. Longeran, Joseph Knorr, T. D. Beck, etc.

The Tacony Iron & Metal Works Company have awarded to Contractor P. Costello the contract to build a one-story addition, 32 x 114 feet, to their machine shop on State road, below Magee street, Philadelphia, Pa.

Builders A. R. Kerr & Co., of Chester, Pa., are taking figures on a mill addition for Messrs. Benderlin Bros., at the same address. It will be brick, two stories, 60 x 90 feet, with all modern mill and factory conveniences.

The Benjamin Atha & Illingworth Company, of Newark, N. J., has obtained a contract from the Government for thirty-four 4-inch breech-loading rapid-fire rifles. In order to do this work the company has to construct new buildings.

In a recent issue we published an item to the effect that the Buckeye Foundry Company, of Cincinnati, O., had commenced the erection of a new shop. We have since been informed that such is not the case, and therefore wish to make the correction.

J. F. Rogers & Co., of New York City, has been incorporated to manufacture machinery and supplies for engineers, machinists, sawmills, etc.; capital, $25,000. Directors: John F. Rogers, M. J. Rogers and John R. Townsend, of 42 Cortlandt street, New York City.

The Hooven, Owens & Rentschler Company, of Hamilton, O., has awarded a number of important contracts in connection with the construction of the $60,000 plant which the company is soon to build. The structural steel work went to the Columbus Bridge Company, and the contract for the remainder of the building to the J. F. Bender Bros. Company.

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GAS, GASOLINE AND OIL ENGINES

By GARDINER D. HISCOX, M. E.

The only American book on an interesting subject. 279 large pages, 8vo, illustrated with 206 handsome engravings. **$2.50** prepaid to any address.

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SPECIAL CHAPTERS ON

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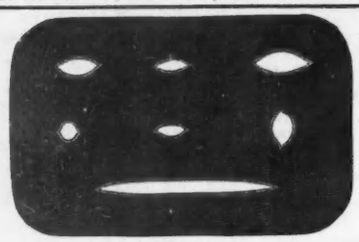

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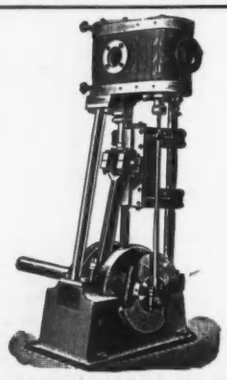

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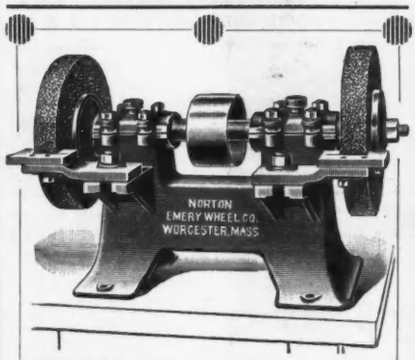

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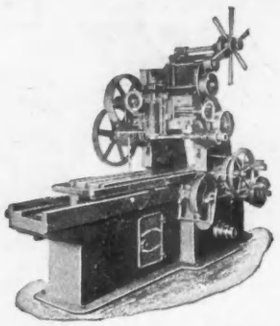
not a very large grinding machine, but it will do a whole lot of work, and do it well. It is one of our new line of Bench and Floor Grinding Machines, made from the latest and most approved designs. The full line is shown in the book.

NORTON EMERY WHEEL CO.
WORCESTER, MASS.

Horizontal Spindle. Milling Machine.



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I have a BROTHER that can BORE.

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B. M. Jones & Co.
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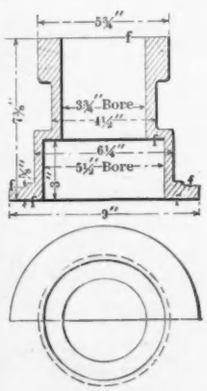
A Gisholt Job.



This Dash Pot was finished as indicated on cut in 45 minutes—not to show, but a regular thing in a manufacturing shop. Can you afford to do such work on a lathe?

Our catalog is interesting to mechanics.

Gisholt Machine Co.
Madison, Wis.

Eastern Branch, 126 Liberty St., New York. Walter H. Foster, Manager.
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Schuchardt & Schütte, Breitegasse 17, Vienna, VII, Austria.

(Continued from page 35.)

October, 1897, $105,460; October, 1896, $12,664; September, 1897, $38,131; first ten months, 1897, $575,874; do., 1896, $298,291.

Quotations.

NEW YORK, Monday, December 27.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 75 @ $12 00
No. 2 foundry, Northern	11 25 @ 11 50
No. 2 plain, Northern	10 75 @ 11 00
Gray forge, Northern	10 25 @ 10 50
No. 1 foundry, Southern	10 75 @ 11 00
No. 2 foundry, Southern	10 25 @ 10 50
No. 3 foundry, Southern	10 00 @ 10 25
No. 1 soft, Southern	10 75 @ 11 00
No. 2 soft, Southern	10 50 @ 10 75
Foundry forge, Southern	9 75 @ 10 00

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.05 @ 1.10c.; refined, 1.10 @ 1.20c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.30 @ 1.50c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some grades perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.50c.

Cold Rolled Steel Shafting—Base sizes, from store, in small lots, 2.30 @ 2.40c.

Copper—Carload lots, Lake Superior ingot, 11c.; electrolytic, 10¾ @ 10⅞c.; casting copper, 10½ @ 10¾c.

Pig Lead—Carload lots, 3.70 @ 3.75c., f. o. b., New York.

Pig Tin—For 5 and 10-ton lots, 13.70 @ 13.80c., f. o. b.

Spelter—Carload lots, 3.85 @ 3.95c., New York delivery.

Antimony—From 7¼ @ 8¼c., according to brand and quantity.

Lard Oil—Prime city, present make, commercial quality, in wholesale lots, 38 @ 41c.

▲ ▲ ▲

Manufactures.

At Norway, Me., Will Austin is putting up a new machine shop.

At Allentown, Pa., the Heilman Boiler Works will build an addition.

The Enterprise Enameling Company, of Bellaire, O., is to erect a new factory.

Owing to an increase of trade, the Lebanon (Pa.) Chain Works will be enlarged.

The Donaldson Iron Company, at Emaus, Pa., is to make additions to its plant.

The Benson Knitting Company, of Rockford, Ill., is to place new machinery.

The E. B. Eddy Company, of Ottawa, Canada, expects to enlarge its plant next spring.

The Boston Electric Light Company has decided to erect a plant in South Boston, Mass.

The Atlantic Refining Company, of Philadelphia, Pa., is about to erect a new pump house.

At Philadelphia, Pa., Architects Dull and Peterson have plans for a three-story factory, 71 x 35 feet.

The Cambridge (O.) Manufacturing Company (S. W. Nicholson, manager) contemplates building an addition.

The Pen Argyl machine shops, at Pen Argyl, Pa., were recently destroyed by fire. The loss is estimated at $25,000.

The Ford Morocco Company, Wilmington, Del., has decided to put in a new engine in the new electric-light plant.

The Diamond Rubber Company, of Akron, O., has reorganized and increased its stock. New buildings are to be erected.

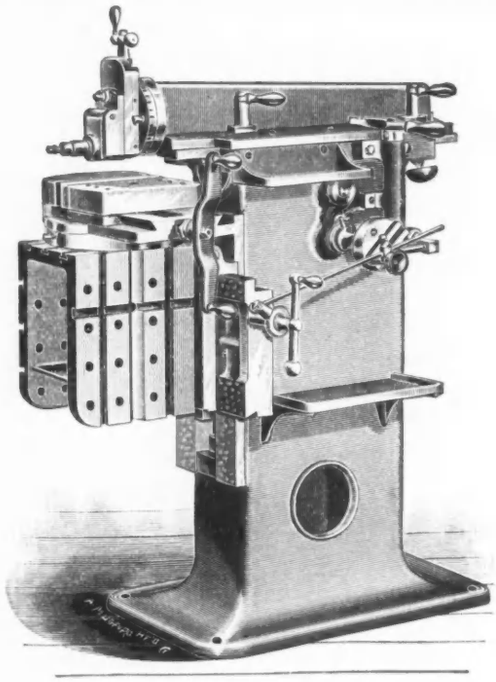
The Dillon Machine Company, of Lawrence, Mass., has been incorporated. I. P. Dillon is president and H. C. King treasurer.

Mr. James N. Gamble, of Cincinnati, O., has secured a permit for the erection of a factory building on Central avenue, that city.

The United States Iron & Tin-Plate Manufacturing Company, of Demmler, Pa., have made an addition to their plant recently.

At Pittsburg, Pa., the J. L. Robinson Company has leased a building, in which they will engage in the manufacture of metal polish.

(Continued on page 37.)



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15-inch Hendey Shaper.

Latest Improvements.
Useful Attachments.
Strong and Powerful.

...FOR...

Die Work, Tool Room or General Shop Work.

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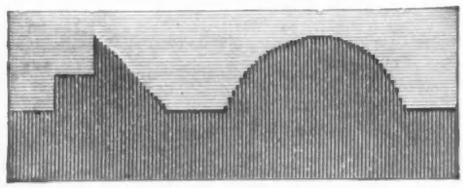
The stroke can be adjusted for curves with machine in motion. The stroke can be adjusted for angles with machine in motion. The stroke can be adjusted for irregular work with machine in motion. It has adjustable table for planing taper work; table can be removed for fastening work to apron. Has a strong graduated swivel vise. Quick work, rapid changes, modern ideas.



This cut shows how stroke can be adjusted with machine in motion by micrometer; adjustment fine and delicate. SEND FOR CIRCULAR.

▲▲▲▲

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TORRINGTON, CONN.

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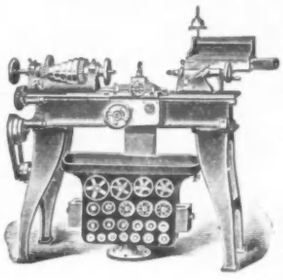
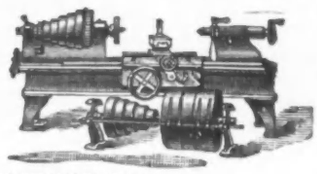
CHAS. CHURCHILL & CO., Ltd., London, and Birmingham, Eng.
ADPHE. JANSSENS, Paris, France.
EUGEN SOLLER, Basel, Switzerland.



ENGINE Lathes for Tool Room and Manufacturing Uses. Gap, Grinding, Monitor and Spinning Lathes, Turret Head Machines.



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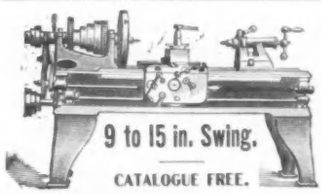
PARIS, FRANCE: Fenwick Freres & Co., 21 Rue Martel.



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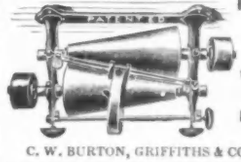
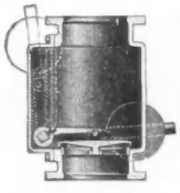


C. W. BURTON, GRIFFITHS & CO., Agents, London, Eng.



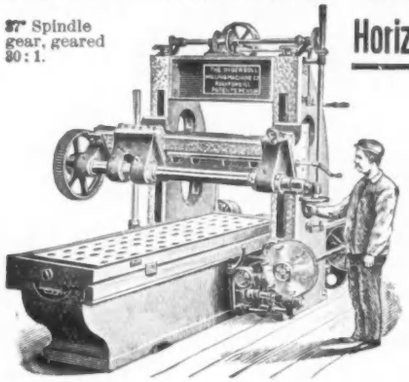
Excelsior Straight-Way Back Pressure Valve.

This valve has no dash pots, springs, guides or complicated levers to get out of order. It is simple, reliable and well made. Never sticks, and can be relied upon at all times when using exhaust steam for heating; or when used as a relief, or free exhaust on a condensing plant, it has no equal. It is noiseless and free from any complicated attachments

JENKINS BROTHERS, New York, Boston, Philadelphia, Chicago.

HEAVY MILLING MACHINES EXCLUSIVELY

37" Spindle gear, geared 30:1.



Horizontal or Vertical Spindles or Both

SIZES:
15", 20", 24", 36", 48", 60", any length.

Wide range of cutter speeds.
Variable table feed from 3-16" to 10" per minute.
Power elevating and lowering device.
Table adjusted by power in either direction.

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The Ingersoll Milling Machine Co.
P.O. Box 2777,
ROCKFORD, ILL., U. S. A.

Foreign Agents: C. W. Burton, Griffiths & Co., London, Eng. A. Janssens, Paris, France. DeFries & Co., Berlin and Dusseldorf.

Eastern Branch, 126 Liberty St., New York.
Cable address, "Ingersoll," Rockford.

36" x 36" x 8' Mach. Net Shp'ng Wgt. 24,000 lbs.

(Continued from page 36.)

At Scottdale, Pa., a new steel mill is to be constructed. Messrs. Wilkins and Davidson have been engaged to superintend the work.

B. F. Perkins & Sons, Holyoke, Mass., are to commence the manufacture of calendar rolls, and a shop for that purpose is to be erected.

The American Stoker Company, of Brooklyn, N. Y., has been incorporated. The directors are R. C. Peabody, David H. Valentine, A. J. Pouch, etc.

The Motive Power Company, of Bowdle, S. D., has been incorporated. The incorporators are John F. McGlenn, William Edwards, Henry C. Mass, etc.

The Movable Fire Escape Company, of Minneapolis, Minn., has been incorporated. The incorporators are Henry Steinmann, Fred Fagien and G. A. Will.

Benjamin Walker is going to build a one-story brick dyehouse, 36 x 64 feet, for J. P. Mathieu & Co., at Ninth and Westmoreland streets, Philadelphia, Pa.

At Port Byron, N. Y., the Port Byron Car Truck Company has been formed. Among the Board of Directors are Henry Fenn, Benjamin Lathrop, S. F. Dixon, etc.

The H. Wales Lines Company, of Meriden, Conn., has signed a contract with A. & S. Blumenthal, of New York, for the erection of a silk velvet mill at Shelton, Conn.

The Otto Gas Engine Works, Philadelphia, Pa., have just installed two 120 horse-power gas engines at Listerville, W. Va., and two 50 horse-power engines at Mannington, W. Va.

The Cincinnati, Hamilton & Dayton Railroad Company is building new shops at Lima, O., and the contract for woodworking machinery has been awarded to J. A. Fay & Co., of Cincinnati, O.

Hart Bros.' Machine Company, Clarksburg, W. Va., have just closed a contract with the Northern Pacific & Alaska Mining, Transportation Company, of Snug Harbor, Alaska, for two sawmill outfits.

The City Foundry Company, of Cleveland, O., has been incorporated for the purpose of engaging in and conducting a general foundry business. The incorporators are James J. Longeran, Joseph Knorr, T. D. Beck, etc.

The Tacony Iron & Metal Works Company have awarded to Contractor P. Costello the contract to build a one-story addition, 32 x 114 feet, to their machine shop on State road, below Magee street, Philadelphia, Pa.

Builders A. R. Kerr & Co., of Chester, Pa., are taking figures on a mill addition for Messrs. Benderlin Bros., at the same address. It will be brick, two stories, 60 x 90 feet, with all modern mill and factory conveniences.

The Benjamin Atha & Illingworth Company, of Newark, N. J., has obtained a contract from the Government for thirty-four 4-inch breech-loading rapid-fire rifles. In order to do this work the company has to construct new buildings.

In a recent issue we published an item to the effect that the Buckeye Foundry Company, of Cincinnati, O., had commenced the erection of a new shop. We have since been informed that such is not the case, and therefore wish to make the correction.

J. F. Rogers & Co., of New York City, has been incorporated to manufacture machinery and supplies for engineers, machinists, sawmills, etc.; capital, $25,000. Directors: John F. Rogers, M. J. Rogers and John R. Townsend, of 42 Cortlandt street, New York City.

The Hooven, Owens & Rentschler Company, of Hamilton, O., has awarded a number of important contracts in connection with the construction of the $60,000 plant which the company is soon to build. The structural steel work went to the Columbus Bridge Company, and the contract for the remainder of the building to the J. F. Bender Bros. Company.

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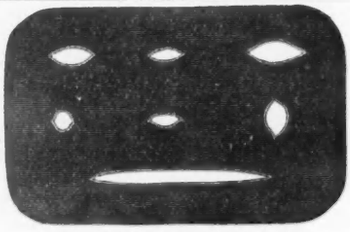

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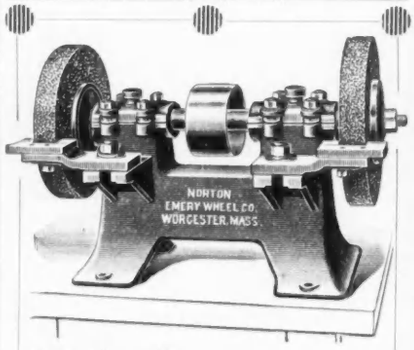

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not a very large grinding machine, but it will do a whole lot of work, and do it well. It is one of our new line of Bench and Floor Grinding Machines, made from the latest and most approved designs. The full line is shown in the book.

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WORCESTER, MASS.

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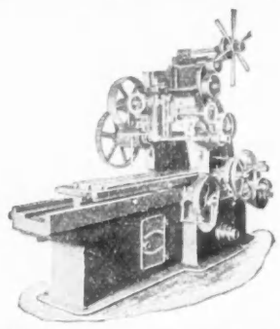

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I have a BROTHER that can BORE.

Write to **BEAMAN & SMITH,**
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SPECIAL AND TITANIC STEELS.

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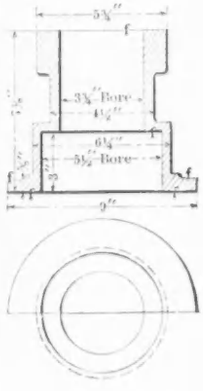
A Gisholt Job.



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Our catalog is interesting to mechanics.

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Madison, Wis.

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Fenwick Freres & Co., 21 Rue Martel, Paris, France.
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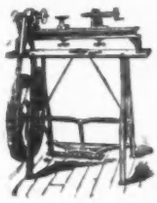
Schuchardt & Schütte, Breitegasse 17, Vienna, VII, Austria.



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1486 Niagara St., Buffalo, N. Y.

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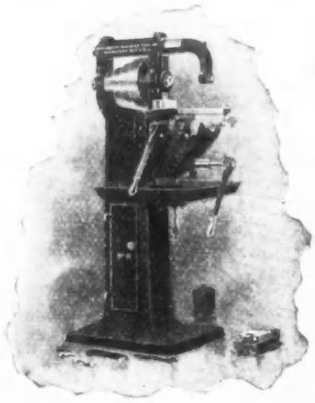
Will cut Sheet Metal and Plates ¼ inch thick or less, in circles, curves or straight away, any length, any width up to 31 inches.

BETHLEHEM FOUNDRY AND MACHINE COMPANY,
South Bethlehem, Pa.

COMBINED DRILL AND COUNTERSINK
FOR CENTERING LATHE WORK.

J. T. SLOCOMB & CO.,
PROVIDENCE, R. I. U. S. A.



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Eccentric Bushings for Adjusting Pinion Shaft. A Rigid, Strong Machine. Net weight about 600 lbs.

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The Strong, Carlisle & Turney Co., Cleveland, Ohio.

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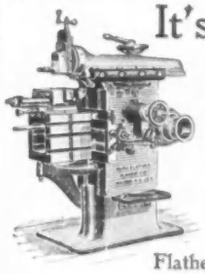

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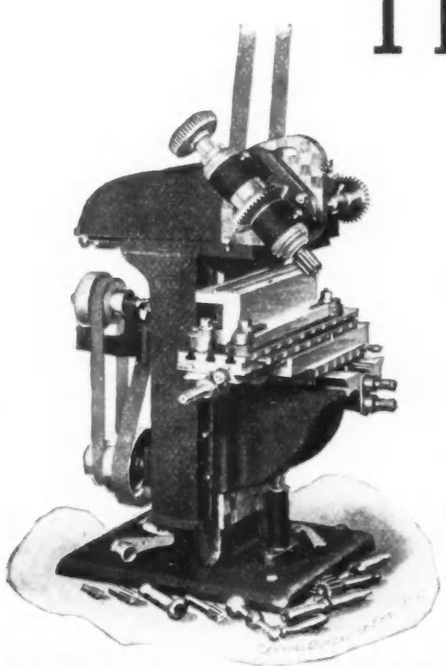

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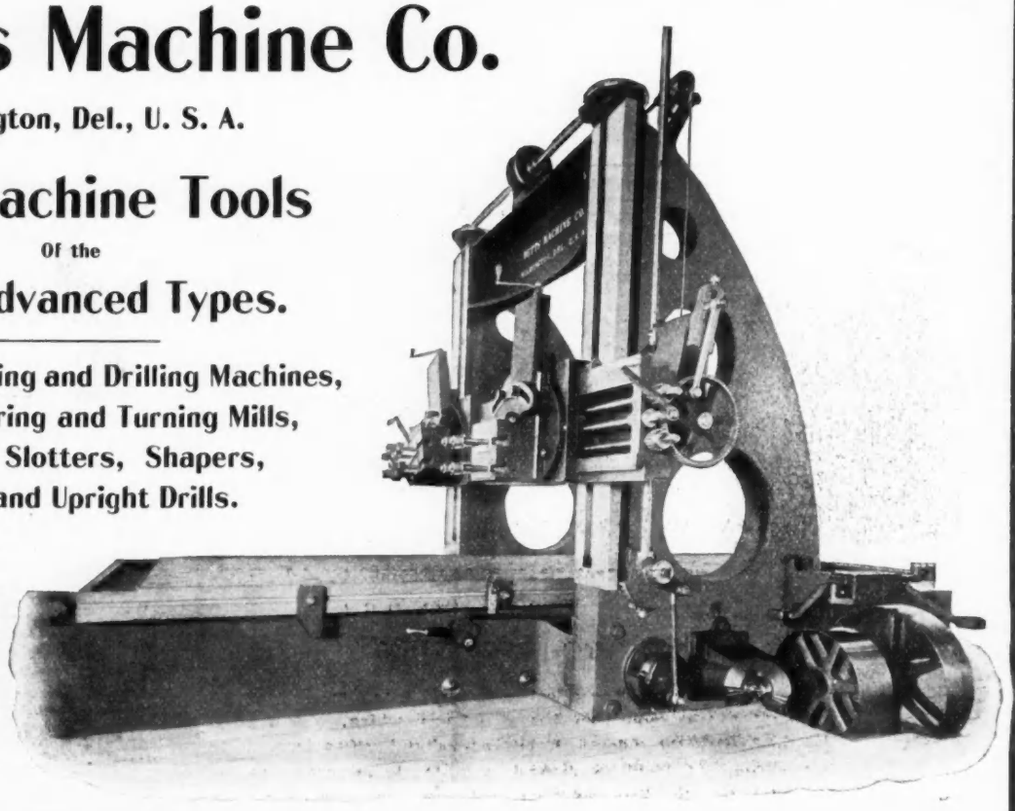

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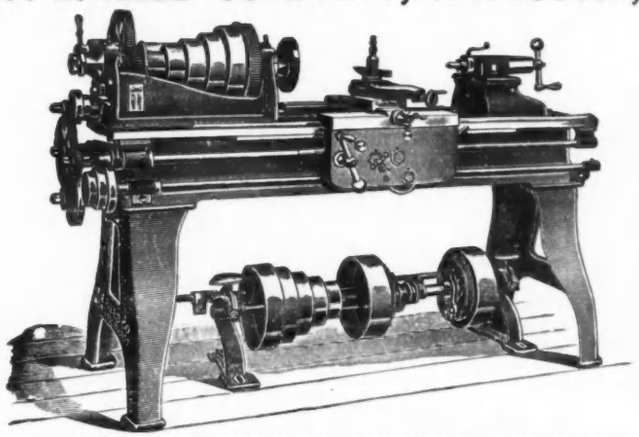

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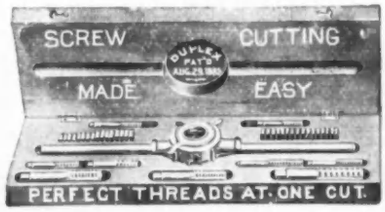

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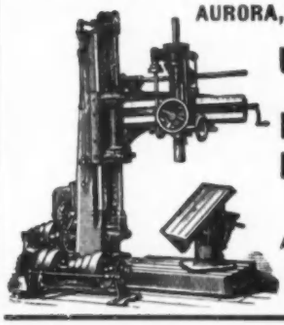

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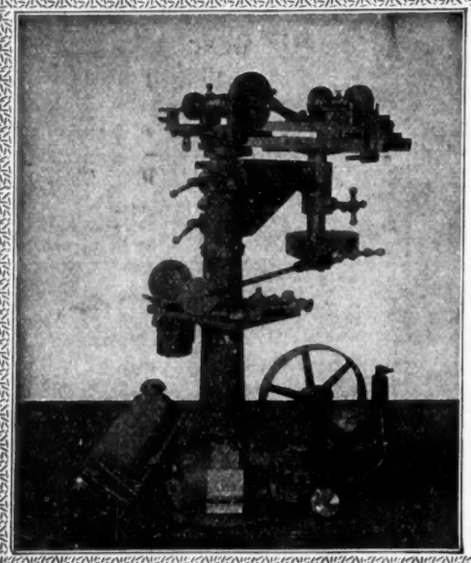

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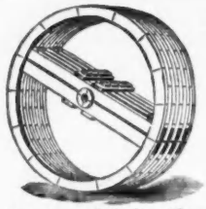

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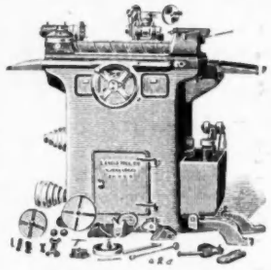

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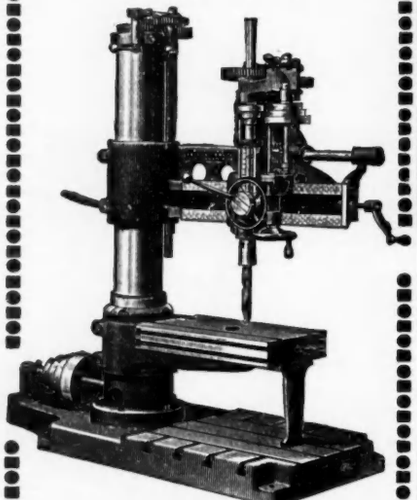

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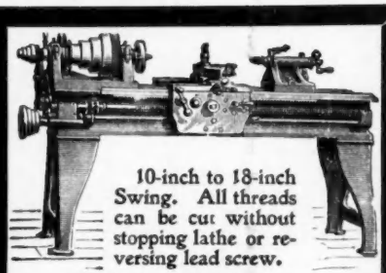

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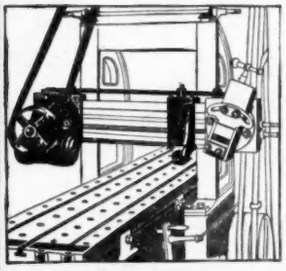

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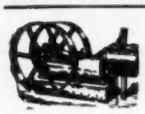

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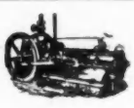

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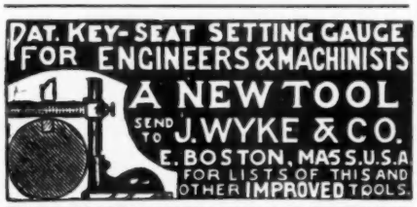
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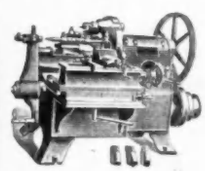

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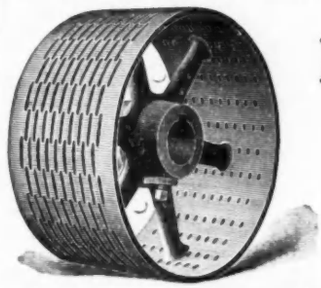

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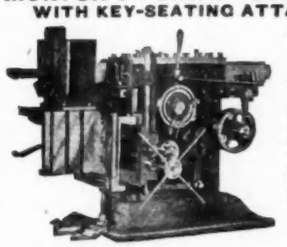

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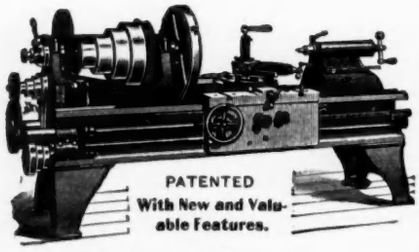

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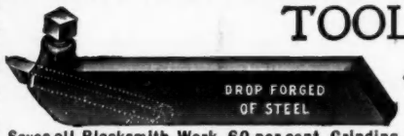

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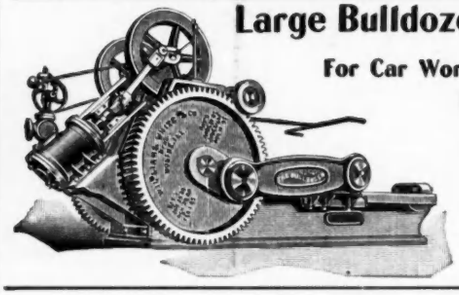

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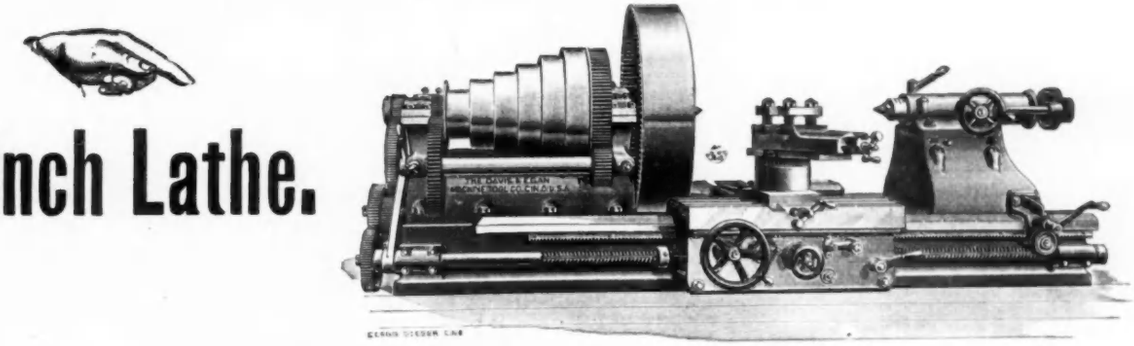

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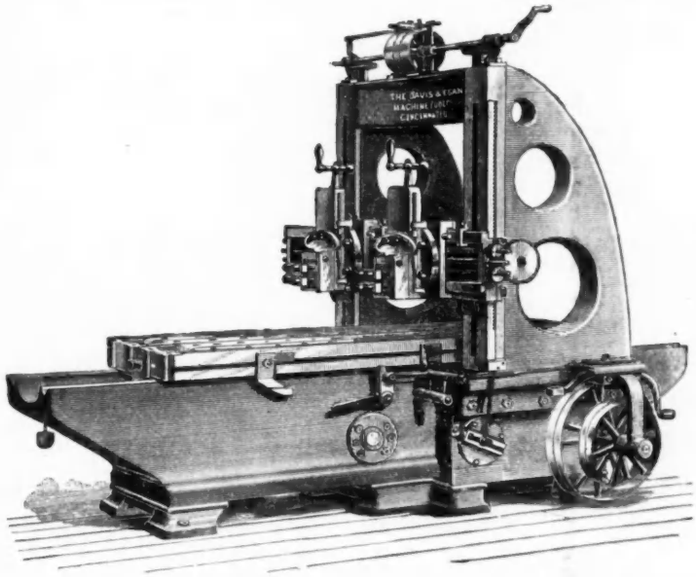

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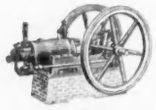

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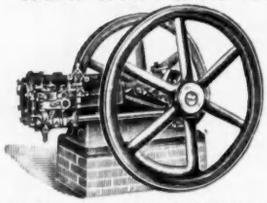

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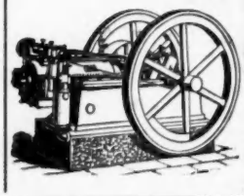

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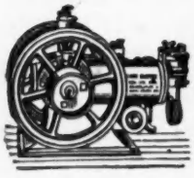

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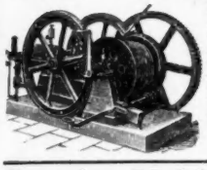

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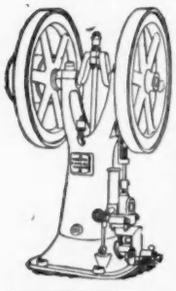

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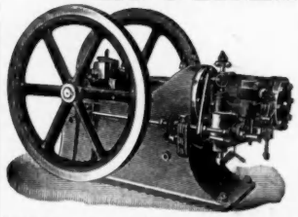

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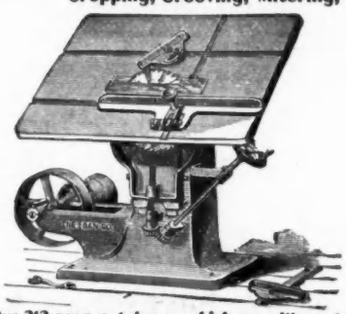

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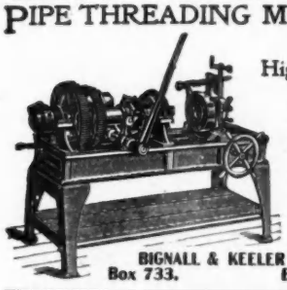

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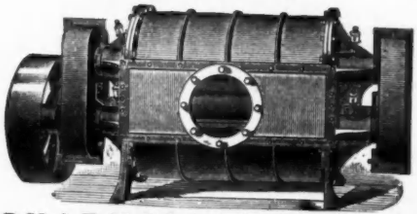

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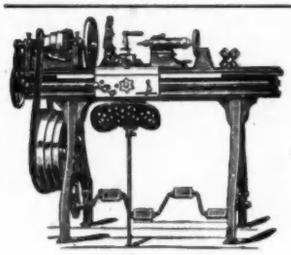

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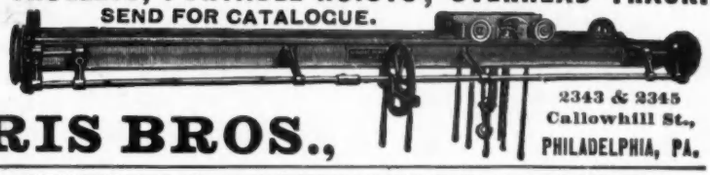

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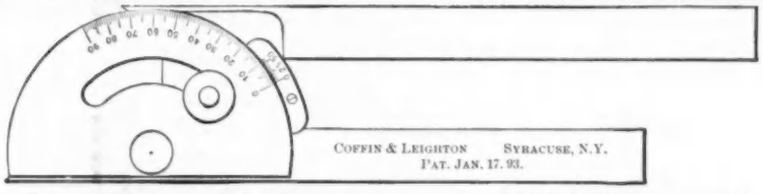

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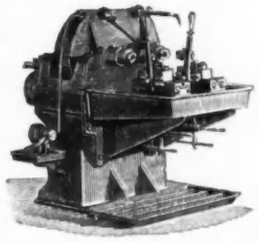

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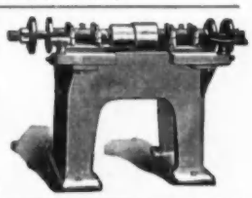

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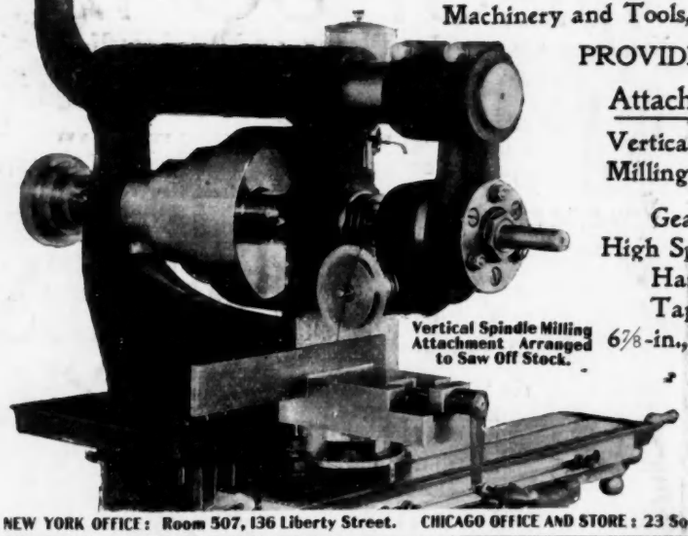

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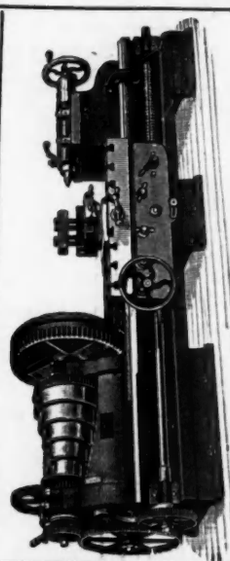

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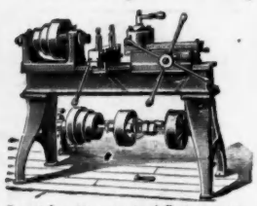

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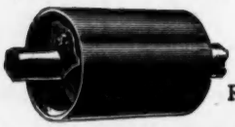

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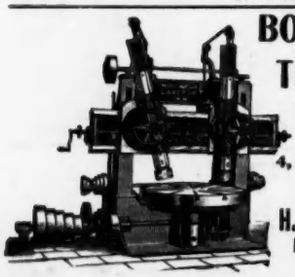

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